

COMPARISON OF 0.5% BUPIVACAINE AND 0.5% LEVOBUPIVACAINE IN INFRACLAVICULAR BRACHIAL PLEXUS BLOCK

Sanhita Kulkarni^A, Amruta Tilwe^B, Vasanti Kelkar^C, Pramod Bhale^A, Prabha Nayak^A
^A - Professor, Department of Anaesthesia, MGM Medical College, Aurangabad, Maharashtra.

^B - Senior resident, Department of Anaesthesia, MGM Medical College, Aurangabad, Maharashtra

^C - Associate professor, Department of Anaesthesia, MGM Medical College, Aurangabad, Maharashtra

Anaesthesia

Manuscript reference number
 NJMDR_5117_16

Article submitted on: 16 Dec. 2016
 Article accepted on: 21 Dec. 2016

Corresponding Author

Dr Sanhita Kulkarni,
 50, Aditya nagar,
 Garkheda,
 Aurangabad.
 Pin - 431009
 Phone no. - 9881300645
 E mail address - drsanhitakulkarni@gmail.com

Abstract:

Back ground: Brachial plexus block can be given via various approaches. Infraclavicular approach is one of them. It has many advantages over other approaches. Levobupivacaine, a pure s-enantiomer of bupivacaine having lower risk of cardiovascular toxicity than bupivacaine has been used less in this approach. In this study we are comparing efficacy and safety of bupivacaine and levobupivacaine in infraclavicular brachial plexus block.

Setting and Design: A randomized double blind prospective study with sealed envelope method was carried out on seventy ASA grade 1 and 2 patients, aged between 18 to 60 yrs scheduled for below elbow surgery.

Material and Methods: The patients were randomly assigned to either group B – Bupivacaine 0.5% (20ml) or Group L – Levobupivacaine 0.5% (20ml) along with 15 ml of 1.5% Xylocaine with Adrenaline. Block was performed with peripheral nerve stimulator (B – Braun)

Statistical Analysis: Unpaired t-test was used for comparison of mean between the two groups. The chi square test was used for qualitative data. A p value of < 0.005 was considered statistically significant. All statistical analysis was done by using SPSS 22

Results: The two groups were comparable in terms of onset of sensory and motor block. The duration of sensory and motor block was 321.6 ±36.5 min, 404.1±77.7 min and 348±68.95 min, 439.29±80.84 min respectively in Bupivacaine and Levobupivacaine group which was statistically significant. There was highly significant prolongation of duration of analgesia in Levobupivacaine group than bupivacaine (B – 420.06±94.23 min, L – 547.85±107.98 min.). Clinically significant complications were absent in both the groups.

Conclusion: Levobupivacaine has significantly longer duration of sensory and motor block as well as longer duration of postoperative analgesia as compared to bupivacaine. Thus it can be preferentially used in infraclavicular brachial plexus block.

Keywords: Bupivacaine, Infraclavicular block, Levobupivacaine

Introduction

Brachial plexus block is the recommended technique for upper limb surgeries. It can be

given by various approaches; infraclavicular (IC) approach is one of them.¹ IC approach is easy to perform, safe and as effective as other approaches to brachial plexus block.

Bupivacaine, a racemic mixture of R and S enantiomer, is commonly used local anaesthetic agent for brachial plexus block. Its higher potential for cardiac toxicity is due to its R enantiomer.^{2,3,4} Levobupivacaine is a pure S enantiomer of racemic bupivacaine and has lower risk of cardiovascular toxicity. It has low affinity to cerebral tissues so gives less CNS depression than bupivacaine.⁵

There is not much previous data comparing these two drugs given by infraclavicular approach. So we compared the efficacy of bupivacaine and levobupivacaine in infraclavicular brachial plexus block. Our primary objectives were to assess onset and duration of sensory and motor blockade and duration of analgesia. Secondary objectives were to assess adverse effects.

Material and methods

After obtaining approval by the institutional ethical committee, written informed consent was taken from all patients for this prospective randomized double blind study. The study population comprised of seventy American Society of Anaesthesiologists grade 1 and 2 patients of either sex, aged 20 -60 years scheduled for below elbow surgery. Patients with infection at the site, history of peripheral neuropathies, coagulation disorders and on anticoagulation therapy were excluded from the study.

All patients included in the study were randomly allocated to one of the two groups of 35 each based on sealed envelope method.

Group B received 20 ml of 0.5% bupivacaine and 15 ml of 1.5% lignocaine with adrenaline

Group L received 20 ml of 0.5% levobupivacaine and 15 ml of 1.5% lignocaine with adrenaline

The patients as well as person performing the block were blind to the study drugs.

Inj. Midazolam 0.05mg/kg IV was given. Infraclavicular brachial plexus block (IBPB) was administered by coracoid approach. The patient was placed in supine position with the head facing away from the side to be blocked. The coracoid process was located and the needle entry point was taken 2 cm medial and 2 cm caudal to the coracoid process. After taking all aseptic precautions, a 22G 100mm

insulated short bevelled needle compatible with the nerve stimulator Stimuplex –DIG (B. Braun, Germany) was inserted perpendicular to the skin. Contractions were elicited starting at 1.5 mA and at frequency at 1-2Hz. As the nerve was approached, movement of the fingers elicited at current of 0.4 mA was taken as endpoint. The study drug was injected in 5 ml increments.

Intra operative monitoring of oxygen saturation, electrocardiogram, non invasive blood pressure and respiratory rate were done.

Patients were assessed for loss of sensation to pinprick over C5-T1 dermatomes using a three point scale. [0=normal sensation 1= reduced sensation 2= absent sensation] every 5 minutes for the first 30 minutes. Time of onset of sensory block was considered when a scale of 2 was achieved.

The motor blockade was assessed using modified Bromage scale, every 5 minutes for the first 30 minutes. 0= no paralysis, 1= loss of wrist flexion, 2= loss of elbow flexion, 3=complete block. Time of onset of motor block was considered when a scale of 2 was achieved. Surgical incision was allowed only when loss of sensation over surgical site and motor block of modified bromage scale 2 was achieved. Failure to achieve this within 30 minutes was considered as failure of block and general anaesthesia was supplemented. Postoperatively patients were assessed every 30 minutes till 8 hr and at 2 hr interval till 24 hr. Duration of sensory block (time interval between the onset of sensory block to dull pain to pinprick) and duration of motor block (time interval between the onset of motor block to movements of fingers) was assessed. Postoperatively, pain was assessed using visual analogue scale (VAS), which was explained to the patient preoperatively where 0 represented no pain and 10 meant worst possible pain. When VAS score was equal to or more than 4, Inj. Diclofenac 75 mg IM was given as a rescue analgesic. Total duration of analgesia was defined as time interval between injection of study drug and requirement of first rescue analgesic.

Complications such as cardiovascular, central nervous system toxicity and pneumothorax if any were noted.

Statistical analysis

In our study considering the drop out rate of 5% and taking power of study as 90% (alpha error of 5% and beta error of

95%), we calculated the sample size as 35 in each group. For statistical analysis the unpaired t-test was used for comparison of mean between two groups. The chi-square test was used for qualitative data. A p- Value of < 0.05 was considered to be statistically significant. All statistical analysis was done by using SPSS 22.

Results

The two groups were comparable with respect to demographic variables. (Table 1)

The onset of sensory block in Group B was 10.57±2.65 min and in group L was 10.29±2.96 min whereas the onset of motor block was 10.86± 2.57 min in group B and 10.00± 2.97 min. in group L. The difference between the two groups was not statistically significant (p>0.05). (Table 2)

The duration of sensory block was 321.6±36.5 min in bupivacaine group compared to 404.1±77.7 min in levobupivacaine group. The difference in duration of sensory block was statistically significant (p value 0.0005). The duration of motor block was 348.30± 68.95 minutes in bupivacaine group and 439.29 ±80.84 minutes in levobupivacaine group. The difference in duration of motor block was statistically highly significant (p value 0.0001). (Table 2)

The mean duration of analgesia in bupivacaine group was 420.06± 94.23 min and in levobupivacaine group was 547.85± 107.98 min. Significantly prolonged duration of analgesia was observed in levobupivacaine group (p value 0.0001). (Figure 1)

Table 1: Demographic parameters

Parameters	Group B	Group L	P value
AGE (years)	36.69 ± 13.64	37.06 ± 14.85	0.9135 NS
Weight (kilogram)	58.03 ± 6.13	58.40 ± 7.44	0.8204 NS

NS = Not significant

Table 2: Types of surgery

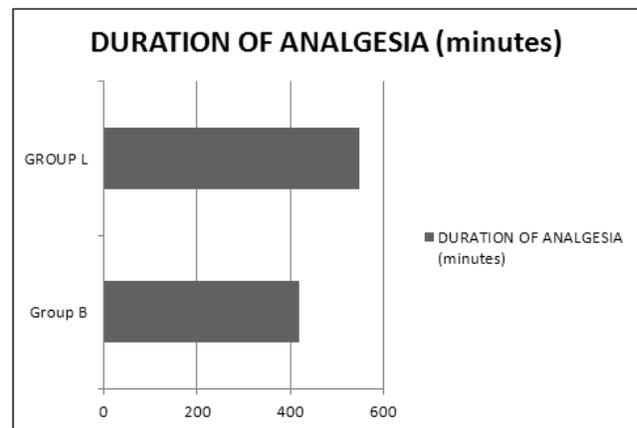
Demographic data	Group B = 35	Group L = 35
Plating of radius or both bone	27	30
Debridement	2	2
Tendon repair	2	1
Finger contracture release	4	2

Table 3: Sensory and motor block parameters

Parameters	Group B	Group L	P value
Onset of Sensory Block (minutes)	10.57 ± 2.65	10.29 ± 2.96	0.672 NS
Duration of Sensory Block (minutes)	321.6 ± 36.5	404.1 ± 77.7	0.000 S
Onset of Motor Block (minutes)	10.86 ± 2.57	10.00 ± 2.97	0.201 NS
Duration of Motor Block (minutes)	348.30 ± 68.95	439.29 ± 80.84	0.0001 HS

NS = Not significant, S = significant, HS = Highly significant

Figure 1: Duration of analgesia



P value – 0.0001 Highly significant

Discussion

Brachial plexus block is an ideal anaesthesia technique for upper limb surgeries as it provides excellent intra and postoperative analgesia.⁶ Infraclavicular block has many advantages over other approaches such as ability to perform block with patient’s head and arm in any position, avoidance of injury to major neurovascular structures of the neck, minimal risk of pneumothorax, better anaesthesia for the arm tourniquet and less frequency of failure to block the musculocutaneous nerve.¹

Racemic bupivacaine is the most commonly used local anaesthetic for brachial plexus block. Levobupivacaine, the pure s-enantiomer of bupivacaine has been developed for the purpose of reducing potential toxicity. Although levobupivacaine has been compared with that of bupivacaine for spinal and epidural, little information is

available comparing the clinical profile of levobupivacaine with bupivacaine in brachial plexus block.

In this study we compared block characteristics of bupivacaine and levobupivacaine. As both the drugs have slower onset of action, we added lignocaine with adrenaline to the study drugs. Addition of adrenaline also helps to diagnose any inadvertent intravascular injection during the procedure.

In our study, the onset of sensory block was similar in both the groups (10.57 ± 2.65 min in group B and 10.29 ± 2.96 min in group L, $p > 0.05$). Cox et al⁷ using supraclavicular approach found statistically insignificant difference in onset of sensory block for 0.5% levobupivacaine and 0.5% bupivacaine (6 min and 8 min respectively).

Cacciapuoti et al⁸ reported the onset of sensory block of 10 min 30 sec \pm 2 min 40 sec, and 18 min 50 sec \pm 4 min 12 sec with levobupivacaine and bupivacaine respectively in axillary brachial plexus block. In our study we did not find any significant difference in the onset of sensory block in both the groups may be due to addition of 1.5% lignocaine with adrenaline in our study drug.

We observed statistically significant difference in duration of sensory block in both the groups which was 321.6 ± 36.5 min in bupivacaine group and 404.1 ± 77.7 min in levobupivacaine group which is consistent with the studies conducted by Deshpande et al⁹ and Pandya et al.¹⁰ However the duration of sensory block in their groups was longer than our study, may be because they had used more volume of long acting local anaesthetic which was 0.4 ml/kg and 0.8 ml/kg respectively.

Liisanantti et al¹¹ did not find any significant difference in duration of sensory block using bupivacaine and levobupivacaine given via axillary approach. Their duration of sensory block was longer than our observation. This may be because they had used larger volume of drug (45 ml).

In our study onset of motor block in group B was 10.86 ± 2.57 min and in group L was 10.00 ± 2.97 min. The difference in onset of motor block between the two groups was statistically insignificant ($p > 0.05$). Cox et al⁷ observed that there was no statistically significant difference in the onset of motor block between 0.5% levobupivacaine and 0.5% bupivacaine when used in supraclavicular brachial plexus block.

In the study conducted by Deshpande et al,⁹ onset of motor block in group L (0.4 ml/kg 0.5% levobupivacaine) was 5.05 ± 0.29 min compared to 5.99 ± 0.49 min in group B (0.4 ml/kg 0.5% bupivacaine) with statistically significant difference. Their onset was earlier than our study as they considered bromage scale of 1 as motor onset while we considered bromage scale of 2 as motor onset. Our study showed no significant difference in onset of motor block between the two groups due to addition of lignocaine with adrenaline.

The duration of motor block observed in group B of our study was 348.30 ± 68.95 min and in group L was 439.29 ± 80.84 min. The difference between two groups was statistically significant ($p < 0.05$).

In the study conducted by Liisanantti et al¹¹ the average time of complete recovery of motor block was 19.3 ± 7.7 hr, 19.5 ± 8.0 hr and 17.3 ± 6.6 hr in bupivacaine, levobupivacaine and ropivacaine groups respectively in axillary brachial plexus block with no statistically significant difference between the groups. Cenk et al¹³ observed that the duration of motor block was 14.55 ± 5.55 hr in bupivacaine group and 13.8 ± 2.95 hr in levobupivacaine group in supraclavicular brachial plexus block. Pandya et al¹⁰ showed that the average duration of motor blockade was 520 ± 20 min in levobupivacaine and 612 ± 89.41 min in bupivacaine group in supraclavicular brachial plexus block which was not statistically significant. In all the above mentioned studies, the longer duration of motor block was due to the use of larger volume of long acting local anaesthetic compared to our study (45 ml, 30 ml and 0.8 ml / kg of drug was used by Liisanantti et al, Cenk et al and Pandya et al respectively). We found prolonged duration of motor block in levobupivacaine group in contrast to these studies where duration of motor block was similar in both the groups. This difference could not be explained.

In our study, mean duration of analgesia in Group B was 420.06 ± 94.23 min and in Group L was 547.85 ± 107.98 min. The difference in duration of analgesia between the two groups was statistically significant ($p < 0.05$).

Deshpande et al⁹ and Pandya et al¹⁰ found that the average duration of analgesia was significantly prolonged in patients receiving levobupivacaine compared to bupivacaine in supraclavicular brachial plexus block. This agrees with our observation. Liisanantti et al¹¹ using axillary approach reported that the average time to first postoperative

analgesic demand was 17.8 ± 7.2 hr in bupivacaine group and 17.1 ± 6.5 hr in levobupivacaine group with no statistically significant difference.

Cenk et al¹³ found that the mean time for first postoperative analgesic demand was 16.6 ± 8.0 hr in group bupivacaine and 14.37 ± 7.27 in group levobupivacaine in supraclavicular brachial plexus block without any clinically significant difference. As compared to our finding, the duration of analgesia in above studies was prolonged in both the groups. The reason may be use of larger volume of long acting local anaesthetic or use of different approach.

We did not observe any complications in both the groups.

Limitation of the study

Though our study suggests that levobupivacaine has better block characteristic as compared to bupivacaine, we did not come across any cardiovascular or CNS toxicity. A larger sample size may be required to compare the safety profile of both the drugs.

Conclusion

Levobupivacaine has significantly longer duration of sensory and motor block as well as post operative analgesia as compared to bupivacaine. Thus it can be preferentially used for infraclavicular block.

References

1. J. Balavenkat, Dr. Kartik. Infraclavicular block with PNS. System review [internet]. 2015[cited 2015 Nov 7]. Available from: <http://aoraindia.com/application/assets/images/pdf/AORANewsletter2015.pdf>
2. Berde CB, Strichartz GR. Local anesthetics. In Miller RD, editor. Miller's Anesthesia. 8 edition. Philadelphia : Churchill Livingstone, 2015:1028-1082
3. Stoelting RK, Hiller S C. Local anaesthetics in Pharmacology and physiology in anaesthesia practice. 5th edition. Philadelphia: Lippincott William and Wilkins; 2014.282-308
4. Manuel Galindo Arias. Levobupivacaine: a long acting local anaesthetic, with less cardiac and neurotoxicity. Update in anesthesia;2002;14:7
5. R. Parpaglioni, M.G. Frigo, A. Lemma, M. Sebastiani, G. Barbati, D. Celleno. Minimum local anaesthetic dose (MLAD) of intrathecal levobupivacaine and ropivacaine for Caesarean section. Anaesthesia,2006,61:110-115.
6. Chin KJ, Alakkad H, Adhikary SD, Singh M. infraclavicular brachial plexus block for regional anaesthesia of the lower arm (Review). System review [Internet]. 2015 [cited 2015 Nov 7]. Available from: http://www.cochrane.org/CD005487/ANAESTH_a-comparison-of-a-local-anaesthetic-injection-below-the-collarbone-with-other-injection-techniques-for-providing-anaesthesia-of-the-lower-arm
7. Cox CR, Checketts MR, Mackenzie N, Scott NB, Bannister J. comparison of S(-)-bupivacaine with racemic (RS)- bupivacaine I supraclavicular brachial plexus block. British journal of anaesthesia 1998;80:594-598.
8. Cacciapuoti A, Castello G, Francesco A. levobupivacaine, racemic bupivacaine and ropivacaine in axillary brachial plexus block. Minerva Anesthesiol. 2002 Jul-Aug;68(7-8):599-605
9. Jyoti Deshpande, Ghodaki PS, Sardesai S. comparative clinical study between racemic bupivacaine and levobupivacaine in supraclavicular brachial plexus block. Indian Journal of applied research. 2014 May;4(5):451-454.
10. Charu Pandya, Panjabi GM, Baranda C. analgesic and anaesthetic property of levobupivacaine compared with bupivacaine in patients undergoing a supraclavicular brachial plexus block. System review [internet] available from: [http://www.themedicalacademy.in/fxconsult1/userfiles/\(1\)%20ANALGESIC%20%20&%20%20ANESTHETIC%20%20PROPERTY%20%20OF%20%20LEVOPUIVACAIN%20%20COMPARED%20%20WITH%20%20BUIVACAIN%20%20IN%20%20PATIENTS%20%20UNDERGOING%20%20](http://www.themedicalacademy.in/fxconsult1/userfiles/(1)%20ANALGESIC%20%20&%20%20ANESTHETIC%20%20PROPERTY%20%20OF%20%20LEVOPUIVACAIN%20%20COMPARED%20%20WITH%20%20BUIVACAIN%20%20IN%20%20PATIENTS%20%20UNDERGOING%20%20)

A%20%20SUPRA-CLAVICULAR%20%20
BRACHIAL%20%20PLEXUS.pdf

11. O. Liisanantti, J. Luukkonen, P.H.Rosenberg. high dose bupivacaine, levobupivacaine and ropivacaine in axillary brachial plexus block. Acta Anaesthesiol Scand 2004; 48:601-606.
12. Mageswaran R, Choy YC. Comparison of 0.5% Ropivacaine and 0.5% Levobupivacaine for infraclavicular brachial plexus block. Med J Malaysia. 2010 Dec;65(4):302-305.
13. Cenk I, Bombacci E, Yurtlu S, Colakoglu S. efficiency of levobupivacaine and bupivacaine for supraclavicular block: a randomized comparative study. Brazalian Journal of anaesthesiology. 2014;64(3):177-182