Original Research Article

Comparative analysis on efficacy of ropivacaine and bupivacaine for supraclavicular brachial plexus block: Randomized study

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Abstract

Background: Regional anaesthesia in the form of block at the supraclavicular approach to the Brachial plexus is often used for upper limb surgeries. It provides anaesthesia by blocking the middle and lower plexus. This study is to compare efficacy of Ropivacaine and Bupivacaine for supraclavicular brachial plexus block and to note down any other side effects of drugs. **Material and Methods:** One Hundred patients aged 20-60 years, weighing more than 50 kgs were taken up for the study at the tertiary care institute of Gujarat. 100 patients ASA I and ASA II were randomly allocated with sealed envelope method into two different groups of 50 each. Both observer and participant were blinded. GROUP A- received (n=50) 25 ml of 0.5% bupivacaine GROUP B -received (n=50) 25 ml of 0.5% ropivacaine. **Results:** Sensory onset of block between the two groups shows that onset of block is earlier in group B with mean value of 11.90 min compared to group A with a mean value of 14.39 min and is statistically significant. Motor onset of block is higher in Group A with mean value of 19.4 min compared to group B which has a mean value of 14.6 min and is statistically significant. Duration of motor block is longer in group A with a mean value 406.23 min and is statistically significant. **Conclusion:** The duration of sensory and motor blockade was prolonged in Bupivacaine compared to Ropivacaine. There was a faster recovery of motor functions. Inj Ropivacaine group compared to Bupivacaine group. Both local anaesthetics are an effective and reliable choice for anaesthesia of the brachial plexus.

Key Words: Bupivacaine, Motor blockade, Ropivacaine, Regional anaesthesia

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INTRODUCTION

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. Upper extremity regional anesthesia has been a mainstay of the anesthesiologist's armamentarium since hall first reported the use of cocaine to block the brachial plexus in 1884.[1]

Various approaches to brachial plexus block have been described, but supraclavicular approach is the easiest and most consistent method for anesthesia and perioperative pain management in surgery below the shoulder joint. Supraclavicular block is performed where the brachial plexus is presented most compactly at the distal trunk/proximal division level. This compactness may explain the block's historical reputation for providing short latency and complete, reliable anesthesia for upper extremity surgery.[2] However it provides anesthesia of entire upper extremity in the most consistent and time efficient manner and also provides both intraoperative anesthesia and postoperative analgesia without any systemic side effects. Regional anaesthesia in the form of block at the supraclavicular approach to the Brachial plexus is often used for upper limb surgeries. It provides anaesthesia by blocking the middle and lower plexus. The use of supraclavicular block as the primary anesthetic technique avoids the complications associated with general

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anaesthesia, airway instrumentation, provides better postoperative analgesia. Bupivacaine is commonly used as the local anesthetic for brachial plexus anesthesia which belongs to amide group. Bupivacaine binds to the intracellular portion of sodium channels and blocks sodium influx into nerve cells, which prevents depolarization.[3] It was observed that using racemic mixture of bupivacaine resulted in cardiac and central nervous system toxicity in some patients. Ropivacaine is a local anesthetic agent with a chemical formula similar to that of other amino amides. Ropivacaine has been evaluated for brachial plexus block in humans in terms of efficacy and safety. Ropivacaine is less lipophilic than Bupivacaine. It has selective action on the pain transmitting A β and c nerves rather than Aβ fibers, which are involved in motor function. Various studies shows that ropivacaine produces less cardiac as well as central nervous system toxic effects, less motor block and a similar duration of action of sensory analgesia as compared to bupivacaine.[4,5] Studies shows that it has significantly greater safety margin over Bupivacaine because of lower CNS and cardiac toxicity[6] and hence can be used in higher concentrations also. One of the drawbacks of Ropivacaine mentioned is its less intense motor blockade at similar concentration compared to Bupivacaine.[7] Ropivacaine has similar potency to bupivacaine at higher doses, Ropivacaine is less potent than bupivacaine and levobupivacaine at lower doses, such as those used for epidural or intrathecal analgesia. This study is to compare efficacy of Ropivacaine and Bupivacaine for supraclavicular brachial plexus block and to note down any other side effects of drugs.

MATERIAL AND METHODS

One Hundred patients aged 20-60 years, weighing more than 50 kgs were taken up for the study at the tertiary care institute of Gujarat. Ethical approval was taken from the institutional ethical committee and written informed consent was taken from all the participants. All the patients were evaluated thoroughly on the previous day of the surgery. A detailed history, complete physical examination and routine investigations were done for all patients were explained about procedure. Patients were kept Nil per orally for 6 hours before the time of surgery and on the previous night premeditated with Diazepam 5 mg and Ranitidine 150 mg. 100 patients ASA I and ASA II were randomly allocated with sealed envelope method into two different groups of 50 each. Both observer and participant were blinded. GROUP A- received (n=50) 25 ml of 0.5% bupivacaine GROUP B -received (n=50) 25 ml of 0.5% ropivacaine Patient was shifted to operating room, Standard monitors connected: Non-invasive blood pressure (NIBP) Heart rate (HR)-electro radiography (ECG), oxygen saturation using standard pulse oximeter (spo2) which were recorded at five minutes intervals during initial period. An IV line was secured in all patients. Supraclavicular brachial plexus block was performed according to the technique described by Winnie, where observer and participant were blinded according to study. Patients will be placed in supine position with the head turned away from the side to be blocked. Arm to be anesthetized was kept in adduction and extended towards the ipsilateral knee as per as possible. Supraclavicular area aseptically prepared and draped. An intradermal wheal raised about 1 cm above the midclavicular point. Subclavian artery palpable in supraclavicular fossa used as landmark. Brachial plexus was approached by supraclavicular route using a 22 gauge needle behind the artery in a caudal, slightly medial and posterior direction till paraesthesia in the forearm elicited or the first rib is encountered. On localization of brachial plexus, aspiration for blood should be performed before incremental injections of a total volume of around 25 ml of local anesthetic. The following parameters were find out and discussed in the study. Vital parameters: Blood pressure, heart rate, oxygen saturation. Onset of action of sensory block: The time interval between the administrations of local anaesthetic to loss of pin prick sensation. Onset of action of motor block: The time interval between administrations of local anaesthetic to loss of motor movements. Duration of sensory block: Time interval between losses of pain prick sensation to appearance of pain prick sensation. Duration of motor block: Time interval between losses of movements to appearance of movements. Sensory block was assessed by pinprick method.

Grade 0- sharp pain felt
Grade 1- analgesia, dull pain felt
Grade 2- anesthesia, no sensation felt.

A modified Bromage scale for the upper extremity was used to assess motor function.

0- Able to raise the extended arm to 900 for a full 2 sec
1. Able to flex the elbow and move the fingers but unable to raise the extended arm
2. Unable to flex the elbow but able to move the fingers 3. Unable to move the arm, elbow or fingers
3. Unable to move the arm, elbow or fingers

RESULTS

The two groups were matched for age and body weight. They are comparable. Sensory onset of block between the two groups shows that onset of block is earlier in group B with mean value of 11.90 min compared to group A with a mean value of 14.39 min and is statistically significant. This difference was statistically highly significant ($p<0.001$). Motor onset

of block is higher in Group A with mean value of 19.4 min compared to group B which has a mean value of 14.6 min and is statistically significant. This difference is statistically highly significant ($p<0.001$). Comparison of duration of block between the two groups shows that sensory duration of block is longer in group A with a mean value of 446.20 min compared to group B with a mean value of 420.65 min and is statistically significant. Duration of motor block is longer in group A with a mean value 406.23 min and is statistically significant. These differences in duration of block in two groups is statistically highly significant ($p<0.001$).

Table 1: Comparison of mean Age and Weight of two groups

	Group	N	Mean	Standard Deviation	P value
Age	Bupivacaine	50	38.10	7.3	0.09
	Ropivacaine	50	35.90	10.4	
Weight	Bupivacaine	50	65.47	5.01	0.1
	Ropivacaine	50	66.90	6.23	

Test applied student t test, Statistically significance at p≤0.05

Table 2: Onset time of sensory block

	Group	N	Mean	Standard Deviation	P value
Sensory onset of block	Bupivacaine	50	19.4	1.20	0.001*
	Ropivacaine	50	14.9	0.7	

Test applied student t test, *indicates statistically significance at p≤0.05

Table 3: Onset time of motor block

	Group	N	Mean	Standard Deviation	P value
Motor onset of block	Bupivacaine	50	14.39	1.12	0.04*
	Ropivacaine	50	11.90	0.59	

Test applied student t test, *indicates statistically significance at p≤0.05

DISCUSSION

In present study use of brachial plexus were preferred to block for the patients undergoing upper extremity surgeries. It is well accepted component of comprehensive anaesthesia care and of great value particularly in the patients who are poor risk for surgery and in emergency situations where patients are with full stomach and prone for aspiration. It provides excellent anaesthesia without loss of consciousness and protective airway reflexes. Anaesthesiologists opt for familiar approaches of brachial plexus anaesthesia such as interscalene, supraclavicular and axillary. However, each has its own limitations and complications. But supraclavicular approach has been considered the most efficacious approach to brachial plexus block because in this approach we block the trunks of brachial plexus.[8] Peripheral nerve blocks have become important in clinical practice because of their role in post-operative pain relief, shortening of patient recovery time and avoiding risks and adverse effects of General Anaesthesia Ropivacaine was identified in 1957. Onset of sensory and motor block was faster in Ropivacaine in comparison to Bupivacaine. The duration of sensory and motor blockade was prolonged in Bupivacaine compared to Ropivacaine. There was a faster recovery of motor functions in Ropivacaine group compared to Bupivacaine group. Demographic data like age, gender, male to female ratio and ASA status were taken into consideration. The groups were comparable in terms of age, gender and weight. Comparison of gender distribution among the two groups shows that males were higher in both the groups when compared to the females, which was statistically not significant. ASA status in both groups is comparable. ASA 1 and 2 patients were taken for study. It was similar to the study by Gonuguntla SB in 2016[9] who studied 60 patients aged between 18 and 60 years old of both sex of ASA I and II undergoing elective upper limb surgeries under supraclavicular brachial plexus block. Results of the their study too, did not show significant difference in the demographic data of the groups of patients as regard age, male to female ratio, ASA physical status. The onset of sensory block was earlier in 0.5% ropivacaine with a value of 11.93 min compared to 0.5% bupivacaine with a value of 14.33 min. Motor onset of block was earlier in ropivacaine with a value of 14.9 min. The above observations were similar to studies conducted by K Shaw *et al.*[10] and Himatvaghadia *et al.*[11] Duration of motor and sensory blockade was longer in bupivacaine. The results of our study support Kaur A *et al.* in 2015 conducted a prospective randomized study in 50 patients aged between 18-55 years. They concluded that onset of action of sensory, motor block was early in ropivacaine group with faster recovery of motor functions as compared to Bupivacaine group. Modak S *et al.*, in 2016 conducted a prospective double blind randomized study involving 60 patients of either sex, ASA 1 and 2. They received 30 ml

of ropivacaine 0.5% and bupivacaine 0.5%. Ropivacaine had earlier onset of sensory and motor blockade compared to Bupivacaine. The duration of block was longer in ropivacaine. McGlade DP *et al.*[12] showed that duration of motor block was significantly longer in the 0.75% ropivacaine group as compared to 0.5% bupivacaine. Reader JC *et al.*[13] Found that motor blockade with 0.75% ropivacaine was comparable to 0.5% bupivacaine. However, studies conducted by McLellankj, Faulds D[14] concluded that Ropivacaine is a well-tolerated regional anaesthetic with an efficacy broadly similar to that of bupivacaine, but has a lower propensity to produce Motor blockade. Hickey R *et al.* in 1991 observed that there were no much statistically and clinically differences in onset and duration of block in their study. Gonuguntla SB in 2016[9] and Babu N *et al.* in 2014[15] observed adverse effects such as Nausea, vomiting, arterial puncture, tachycardia, seizures, horner's syndrome in their study. There were no such adverse effects in our study.

CONCLUSION

The duration of sensory and motor blockade was prolonged in Bupivacaine compared to Ropivacaine. There was a faster recovery of motor functions. Inj Ropivacaine group compared to Bupivacaine group. Both local anaesthetics are an effective and reliable choice for anaesthesia of the brachial plexus. Both the drugs maintain stable hemodynamic profile perioperatively and are devoid of any side effects at the concentration and volumes used for the study.

REFERENCES

1. Hall RJ. Hydrochlorate of cocaine. NY Med J. 1884;40:643-46.
2. Brown DL, Cahill DR, Bridenbaugh LD. Supraclavicular nerve block: anatomic analysis of a method to prevent pneumothorax. Anesth Analg. 1993;76:530-4.
3. Laura Clark. Anatomy of brachial plexus.3rd ed. Chapter 6. In: Peripheral nerve blocks, Chelly JE, 3rd ed 2009, 44-57.
4. Brown DL. Upper extremity anatomy.2nd ed. Chapter - 2. In: Atlas of regional anaesthesia. Philadelphia, PA: WB Saunders com 1999, 16-22.
5. Hardman JG, Limbird LE, Goodman Gillman A. Local Anaesthetics in: The Pharmacological Basis of Therapeutics, 10th Edition, United States of America McGraw Hill 2001.
6. Akerman B, Helberg IB, Trossvik C. Primary evaluation of the local anaesthetic properties of amino amide agent ropivacaine (LEA 103). Acta Anaesthesiol Scand. 1988;32:571-8.
7. Hickey R, Candido KD, Rammurthy S, Winnie AP, Blanchard J, Raza SM, et al. Brachial plexus block with a new local anaesthetic 0.5% ropivacaine. Can J Anaesth. 1990;37:732-8.
8. Klein SM, Greengrass RA, Steel SM. A comparison of 0.5% bupivacaine, 0.5% ropivacaine and 0.75% ropivacaine for interscelene brachial plexus block. Anesthesia Analgesia. 1998;87:1316-91.
9. Gonuguntla SB. Effect of 0.5% Bupivacaine Versus 0.75% Ropivacaine-Onset, Duration and Quality of Brachial Plexus Block through Supraclavicular Approach. International Journal of Scientific Study 2016;3(11):244-8.
10. Ellis H, Feldman S, et al. Anatomy for Anaesthetists. 8th ed. Massachusetts 2004;64:307-14.
11. Vaghadia H, Chan V, Ganapathy S, et al. A multicentric trial of Ropivacaine 7.5mg/mL vs bupivacaine 5 mg/mL for supraclavicular brachial plexus anesthesia. Canadian Journal of Anesthesia, 1999;46-10: pp 946-951.
12. McGlade DP, Kalpokas MV, Mooney PH. A comparison of 0.5% Ropivacaine and 0.5% Bupivacaine for axillary brachial plexus Anaesthesia. Anaesthesia intensive care 1998;26:515-520.
13. Raeder JC, Drosdahl S, Klaastad O, et al. Axillary brachial plexus block with Ropivacaine 7.5mg/mL. A comparative study with Bupivacaine 5mg/mL. Acta Anesthesiol Scand 1999;43:794-798.
14. McClellan KJ, Faulds D. Ropivacaine, an update of its use in regional anaesthesia. Drugs 2000;60:1065-1093.
15. Babu N, Sreeraghu GM, Sreeharsha S, Dwideep Chandra P, Dhingra U. A comparative study of bupivacaine 0.5% and ropivacaine 0.5% for supraclavicular brachial plexus block (Perivascular approach). Journal of evolution of medical and dental sciences 2014;3(43):10722-32.

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