

Comparative study of lignocaine, bupivacaine alone and in combination in supraclavicular block

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Abstract

Introduction: Brachial plexus block, which involves blocking the nerve supply to upper limb, will effectively anaesthetize the upper extremity.

Material & Methods: The present study of "supraclavicular brachial plexus block using Bupivacaine was carried out at Owaisi Hospital and Research Centre, Deccan College of Medical Sciences from the period of March 2015 to August 2015. A total number of 60 patients were divided into three groups of 20 patients each. The patients scheduled to upper extremity surgery were selected for the study and undergone with supraclavicular brachial plexus block. After approval from Ethical committee, study was started.

Results: Combination of Lignocaine and Bupivacaine provided the advantages of rapid onset and prolonged duration of action. The short onset time due to Lignocaine minimized the waiting time for commencement of surgery and long duration of action due to Bupivacaine catered for prolonged surgery. The 100% success rate and excellent quality of block without the need for further supplementary anaesthesia gives the advantage for conducting long duration surgeries and in addition good Post operative analgesia is also achieved.

Conclusions: Thus we conclude that Lignocaine and Bupivacaine combination is superior to Individual drug given alone and it combines the better qualities of both the drugs.

Keywords: Supraclavicular brachial plexus block, Lignocaine, Bupivacaine, Analgesia, Advantage

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Introduction

Pain is one of man's most compelling experiences. It is unpleasant sensation which only the individual himself can appraise and as such incapable of a satisfactory definition. Relief of pain is an important aspect during and after surgery^[1].

Various techniques and regional anaesthesia are used to relieve the pain in upper limb in addition to GA.

Regional Anaesthesia may be defined as the application of a local anaesthetic agent to a nerve trunk far away from the effected region to block the nerve impulses reversibly to the part innervated^[1].

Brachial plexus block, which involves blocking the nerve supply to upper limb, will effectively anaesthetize the upper extremity. Apart from local anesthetic drugs various adjuvants are used in brachial plexus block e.g.:- clonidine, opioids mainly to improve intensity of analgesia, to increase duration of action and to achieve faster onset^[2].

The more recent perivascular techniques use the concept that there is a fascial envelope surrounding the plexus throughout most of its course.

Therefore, just like epidural anaesthesia, brachial plexus anaesthesia can be produced by single injection into this perineural space and extent of anaesthesia that results will depend on level of injection and volume of anaesthetic solution injected^[3].

Supraclavicular brachial plexus block is an acceptable technique for arm, forearm surgeries. The confidence and cooperation of the patient must be obtained, without them success will be poor.

Prerequisites to obtain good blockade:

1. A thorough knowledge of anatomy.
2. Patience and gentleness in performing the block.
3. Waiting for sufficient time for the drug to act.

The purpose of this study was to compare and evaluate the onset of analgesia, duration of analgesia, quality of Motor Block, supplementation Required, Haemodynamic and Respiratory effects, and any associated complications using Bupivacaine, Lignocaine and a combination of Lignocaine and Bupivacaine for Supraclavicular brachial plexus block.

Material & Methods

The present study of "supraclavicular brachial plexus block using Bupivacaine was carried out at Owaisi Hospital and Research Centre, Deccan College of Medical Sciences from the period of March 2015 to August 2015.

The patients scheduled to have upper extremity surgery were selected for the study.

The anaesthesia was by supraclavicular brachial plexus block. All the patients belonged to ASA grade I and grade II and were of both sex. After approval from Ethical committee, study was started.

Exclusion Criteria: Patients with Neurological disorders, Anaemia, Hypertension and any Cardiac and Respiratory disorders were excluded from the present study.

All patients were within the Normal Haematological and Urological parameters. The patients were explained and reassured about the procedure. Informed consent was obtained.

A total number of 60 patients were divided into three groups of 20 patients each.

Group I: Patients received 30ml of Bupivacaine 0.5%

Group II: Patients received 30ml of Lignocaine 2%

Group III: Patients received 10ml of 2% Lignocaine and 20ml of 0.5% Bupivacaine

In all the patients intravenous line was secured with 18G IV cannula and 5% dextrose was started. Midazolam 0.03-0.05mg/kg body weight was administered intravenously as premedication.

Position of the patient

Maximum care was taken in proper positioning of the patient, as it is one of the essential features for a successful block. Patient was placed

- a. Supine
- b. With a pillow under the shoulders
- c. Head turned to opposite side
- d. Arm drawn down to depress the shoulder

In this position the upper surface of the first rib is raised anteriorly and ensures more space and better approach to the plexus.

Skin Preparation

Skin preparation included the lateral aspect of neck, supraclavicular fossa and the axillary aspect of upper arm. Strict aseptic conditions are observed while performing the procedure as for any surgical procedure.

Technique

- Supraclavicular brachial plexus block, as described by Macintosh and modified by Ball was used in the present series.
- An intradermal wheal was raised 1 cm: above the midpoint of the corresponding clavicle with ½ cc of analgesic solution.
- The external jugular vein was identified and subclavian artery palpated 1 cm above the midpoint of clavicle.

A 22 gauge needle with a syringe loaded with analgesic solution was introduced through the skin taking care not to injure the external jugular vein at the

same time the subclavian artery was palpated and pushed medially to prevent puncturing or accidental injection in to the vessel.

The needle was passed downwards, backwards and medially towards the upper surface of first rib. In some cases, before the upper surface of first rib was reached, paraesthesia was felt, as a sense of tingling, numbness or shooting burning pain along the upper limb. In such cases analgesic solution was deposited as a single shot.

When paraesthesia was not elicited, the needle was directed downwards, backwards and medially till it comes in contact with the upper surface of first rib. Sometimes it is likely to miss the first rib, in such cases, the needle was advanced inwards cautiously till it struck the upper surface of first rib.

No attempt was made to elicit paraesthesia, repeated movements of needle are likely to damage the blood vessels, nerves and pleura. It was frequently observed that, the pulsations of subclavian artery were transmitted to the needle and this in fact serves as a useful guide to the correct placement of the needle.

When the needle struck the upper surface of the first rib, the needle was withdrawn for 2 to 3 mm so that it was in the same plane as brachial plexus, i.e., superficial to the deep fascia of neck. After a negative aspiration for blood and air, the analgesic solution was deposited. Intermittent negative aspiration, is done while injecting the analgesic solution to make sure that the needle was not in the subclavian vessel and to confirm that the needle did not enter the pleura or lung parenchyma.

The medial aspect of upper arm, right up to the elbow supplied by the intercostobrachial nerve which is the lateral cutaneous branch of anterior primary ramus of the second thoracic nerve, is not anaesthetised by this block. This is blocked at the medial aspect of upper arm by infiltrating 5 cc of analgesic solution, starting at acromioclavicular joint, coming downwards over the medial aspect of arm up to insertion of pectoralis major.

As soon as the block was given, patients were kept comfortably with the arm by the side.

Onset of analgesia: It was taken as the period from the time of injection of analgesic solution to the absence of pin prick sensation as experienced by the patient.

Duration of Analgesia: It was taken as the period from the time of loss of pinprick sensation to the first appearance of pain as experienced by the patient.

Intensity of Motor Block:

- a. **Complete:** Those blocks in which there was no movement of the entire limb (or) patient was unable to lift up the limb, was classified as complete.
- b. **Incomplete:** Block in which there was movement of fingers or wrist or when patient was able to lift up the limb by minimum effort, was classified as incomplete motor

c. **Failures:** When full range of movement of entire limb was present was classified as failure.

Sensory loss was tested by pinprick method. Motor block was tested by asking the patients to move the limb or flex the wrist.

After the surgery clinical evaluation of the Analgesia, Cardiovascular and Respiratory parameters was continued into the recovery room and postoperative ward.

All events were recorded in proforma prepared and master charts, individual tables were drawn from the findings and results were calculated statistically.

Results

The following were Compared and Evaluated between the Three Groups after performing Supraclavicular Brachial plexus Block.

1. Onset of Analgesia
2. Duration of Analgesia
3. Intensity of Motor Block
4. Supplementation required
5. Haemodynamic and Respiratory effects
6. Complications if any.

The results and observations of the present study were analysed using ANOVA (Analysis of variance), F-test. All values are expressed in terms of Mean \pm SE (standard error). Probability value (p value) was considered significant when P-value was less than 0.05 and was considered highly significant when $P < 0.001$ and considered non-significant if $P > 0.05$.

Demographic data: The Mean Age in Group-I was 43.10 yrs, in Group-II was 42.10 yrs and in Group III was 42.35 yrs. The Male to Female ratio is same in all the three groups 13:7.

The Mean Weight in Group-I was 62.40 kg, in Group-II was 63.10 kg and in Group-III was 62.20 kg.

Onset & duration of analgesia: The mean time for onset of analgesia was 17.4 minutes, 6.40 min and 7.1 min respectively in Group I, II & III. The difference between onset of analgesia in 3 groups was highly significant [F ratio 261.43 & $p < 0.001$].

The Mean duration of Analgesia in Group I was 469.50 min, Group II was 72.25 min and in Group-III was 490.15 min. The difference between the Mean Duration of Analgesia in all the three groups was Highly Significant [F ratio 1607.46 & $p < 0.001$]. (Table 1)

Table 1: Onset & duration of Analgesia

Group	Onset of Analgesia (minutes)			Duration of analgesia (minutes)		
	Min Time	Max time	Mean time \pm SD	Min Time	Max time	Mean time \pm SD
I	15 min	20 min	17.40 \pm 0.38	440 min	510 min	469.50 \pm 6.052
II	4 min	10 min	6.40 \pm 0.387	55 min	120 min	72.25 \pm 4.183
III	5 min	11 min	7.10 \pm 0.376	450	560	490.15 \pm 7.03
	$p < 0.001$			$p < 0.001$		

Intensity of Motor Block: In group I & II Motor Block was complete in 90% of cases while in group III was complete in 100% cases. In the entire series Complete Motor Block is seen in 93.33% of cases. (Table 2)

Table 2: Intensity of Motor Block

Intensity of motor block		Group I		Group II		Group III	
S. No	Intensity of motor block	No. of cases	%	No.	%	No.	%
1.	Complete	18	90	18	90	20	100
2.	Incompletes	2	10	2	10	0	0
3.	Failures	0	0	0	0	0	0

Supplementation: In Group I, 10% of cases required Supplementation (with thiopentone sodium+N₂O+O₂), in group II, 10% of cases required Supplementation and in group III, none of the cases required supplementation. In the entire Series, 6.66% cases required supplementation.

Cardio respiratory changes

Hemodynamic and respiratory effects:

1. Changes in pulse pressure: Pulse rate changes in three groups was not statistically significant (F ratio 0.08 & $p > 0.05$)
2. Changes in systolic blood pressure: Systolic blood pressure changes are not significant statistically (F ratio 0.22 & $p > 0.05$)

- Changes in diastolic blood pressure: Diastolic blood pressure changes are not significant statistically (F ratio 0.09 & p >0.05)
- Changes in SPO₂: SPO₂ changes were also not statistically significant (F ratio 0.15 & p >0.05)
- Changes in respiratory rate: Respiratory rate changes are not significant statistically (F ratio 0.45 & p >0.05)

Complications

Haematoma, hypotension and bradycardia was observed in one patient each (Table 3)

Table 3: Complications among the three groups

Complications	Group I	Group II	Group III
Local at the site of the injection			
a) Injection into a vein	Nil	Nil	Nil
b) Haematoma	Nil	1 patient (5%)	Nil
c) Puncture of pleura or lung	Nil	Nil	Nil
d) Stellate ganglion block	Nil	Nil	Nil
e) Phrenic nerve palsy	Nil	Nil	Nil
General systemic reactions			
a) Hypotension	1 patient (5%)	Nil	Nil
b) Hypertension	Nil	Nil	Nil
c) Bradycardia	1 patient (5%)	Nil	Nil
d) Tachycardia	Nil	Nil	Nil
e) Drowsiness	Nil	Nil	Nil
f) Convulsions	Nil	Nil	Nil
Delayed complications			
a) Brachial neuritis	Nil	Nil	Nil
b) Delayed recovery from function of the limb	Nil	Nil	Nil
c) Massive lungs collapse	Nil	Nil	Nil

Discussion

The present study of "supraclavicular brachial plexus block using Bupivacaine and Lignocaine" was carried out in patients scheduled to have upper extremity surgery by Supraclavicular Brachial Plexus Block.

Major findings from our study were that combination of Lignocaine and Bupivacaine provided the advantages of rapid onset and prolonged duration of action. The short onset time due to Lignocaine minimized the waiting time for commencement of surgery and long duration of action due to Bupivacaine catered for prolonged surgery. The 100% success rate and excellent quality of block without the need for further supplementary anaesthesia gives the advantage for conducting long duration surgeries and in addition good post operative analgesia is also achieved.

Study done by Bhatia et al (2015)^[4] on clinical evaluation of supraclavicular brachial plexus block in a randomized double blind study observed that the addition of 2% lignocaine with adrenaline to ropivacaine 0.5%, showed the faster onset of block without any effect on the duration of block and analgesia.

Raizada N et al (2002)^[5] study was done to observe the quality of sensory block, onset and duration of sensory and motor block, haemodynamic effects and any associated side effects by using different

concentration of lignocaine, mixture of lignocaine and bupivacaine. Study concluded that the compounding of lignocaine and bupivacaine provided the benefit of individual drug without the use of high volume of one drug alone. The short onset time was similar to lignocaine and hence shortened the waiting time for surgery. The duration of block with lignocaine bupivacaine mixture was longer as that of bupivacaine thus allowing long surgical procedures with added advantage of adequate postoperative analgesia.

A comparison of the motor and sensory block by ropivacaine and bupivacaine in combination

with lignocaine in supraclavicular block by Chandni M Soni, Hetal Parikh (2013)^[6] revealed that Ropivacaine 0.75% and bupivacaine 0.5% showed similar onset and duration for sensory and motor block when used for supraclavicular brachial plexus block along with xylocaine. They also provide almost equal duration of analgesia. Because Ropivacaine has a potentially proven safety profile compared to Bupivacaine, it may offer an advantage.

A similar kind of study done by Ozmen et al (2012)^[7] on the effect of addition of lidocaine to bupivacaine on anesthesia found that Motor block developed fastest in the lidocaine group and the bupivacaine + lidocaine group (P < 0.001). Motor block regression was the fastest in the lidocaine group and the slowest in the bupivacaine + lidocaine group (P <

0.001). Loss of cold and touch sense was the fastest in the bupivacaine + lidocaine group and the lidocaine group ($P < 0.001$). Loss of sense of pain was the fastest in the bupivacaine + lidocaine group ($P < 0.001$). Postoperative analgesia requirement time was delayed in the bupivacaine + lidocaine group ($P < 0.001$).

In a randomized controlled trial on effects on bupivacaine and bicarbonate in supraclavicular brachial plexus block by SP Singh et al (2009) found that that alkalinization of plain bupivacaine significantly improved the supraclavicular brachial plexus block characteristics (e.g. onset of block, time to achieve complete block and quality of block) without any increase in side effects. It has also prolongs duration of analgesia [8].

Thus we conclude that Lignocaine and Bupivacaine Combination is superior to individual drug given alone and it combines the better qualities of both the drugs.

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