Combination of Supraclavicular and Low Interscalene Block with Bupivacaine 0.5% and Lignocaine 5% (Heavy) for Shoulder and Upper Limb Surgery

HN Chandrappa, BS Deepak, Sudeep Mohapatra

ABSTRACT

Background: Surgical procedures on the shoulder and upper limb are ideally suited FOR regional anaesthetic techniques as they are associated with higher degrees of success and lesser incidence of complications. Use of classical interscalene block alone is associated with diaphragmatic paresis and respiratory complications. Supraclavicular and infraclavicular block alone are sometimes not adequate for upper limb surgeries and may be associated with tourniquet pain. With these in mind, it was thought to combine both techniques together to get adequate surgical Anaesthesia with lesser complications.

Patients & Methods: After Ethics committee approval and infirmed consent, 30 patients of ASA I, II and III posted for shoulder and upper limb surgeries were administered combined low interscalene and supraclavicular block by paresthesia technique with a mixture of bupivacaine 0.5% and lignocaine 5% heavy (5:1), total volume administered 30 ml. Onset time of sensory and motor block as per Hollmen scale was recorded. Duration of analgesia and motor block was recorded.

Results: Mean onset time of sensory analgesia was 2 min.30 sec ± 20 sec and motor block at 3 min.10 sec ± 20 sec. Analgesia lasted for a mean duration of 906 ± 217 minutes till first request for additional analgesic. None of the patients needed to be supplemented with general Anaesthesia. None of the patients had complaints of breathing difficulty, or had clinical evidence of accessory muscles of respiration being in use or a drop in saturation below 90%, suggestive of diaphragmatic palsy or pneumothorax.

Conclusions: To conclude, use of combined interscalene and supraclavicular approach to block the brachial plexus was found to be effective as a sole anaesthetic technique with no respiratory compromise.

KEYWORDS: Supraclavicular block, Low interscalene block, Lignocaine 5% heavy, Shoulder surgeries

Surgical procedures on the shoulder and upper limb are ideally suited to regional anaesthetic techniques as they are associated with higher degrees of success and lesser incidence of complications.[1]

Use of classical interscalene block alone is associated with diaphragmatic paresis and respiratory complications.[2] Supraclavicular & infraclavicular block alone are sometimes not adequate for upper limb surgeries and may be associated with tourniquet pain. Axillary block is not suitable for shoulder surgeries as it may be associated with inadequate blockade of terminal nerves that arise from medial, posterior and lateral cords and supply the upper arm.[1] With these in mind, it was thought to combine both techniques to get adequate surgical Anaesthesia with lesser complications.

PATIENTS AND METHODS

Approval was taken from institutional ethics committee, 30 Patients ASA I, II, III aged 18-50 years of either gender posted for shoulder or upper limb surgeries were administered Brachial Plexus Block. An informed written consent was obtained from all patients.

Patients who refused regional anaesthesia, had coagulation abnormalities and sensory motor nerve damage were excluded.

All patients were kept nil per oral for 6 hours prior to the procedure. Patients were premedicated with alprazolam 0.25 mg and omeprazole 20mg orally on the night before elective surgery. Patients were shifted to the operating room and were monitored for - Non invasive blood pressure, 5 lead ECG and Pulse oximeter. 18 G venous access was secured in the non operative hand and dextrose free intravenous fluids were on flow at the rate of 4ml $kg.^{-1}hr^{-1}$. Oxygen was connected by Hudson mask at the rate of $4L/min^{-1}$.

Patient was made to lie supine with a pillow under the shoulder, head extended and turned to opposite side and ipsilateral arm adducted gently by assistant.

The following anatomical landmarks were noted. The interscalene groove was palpated and traced down to mid-clavicular point. Subclavian artery was palpated and a point

Drs. HN Chandrappa, Associate Professor, Deptt. of Anaesthesiology SDU Medical College, Kolar, BS Deepak, Junior Consultant, Sudeep Mohapatra, Resident, Deptt. of Anaesthesia, Sagar Hospitals, Banashankari, Bangalore
Correspondence : Dr. HN Chandrappa, E-mail: chandrappa@hotmail.com

marked 1 cm lateral and posterior to the artery. Skin and subcutaneous tissue was infiltrated with 2ml of lignocaine 2%. A local Anaesthetic combination was prepared with 20ml of bupivacaine 0.5% and 4 ml of lignocaine 5% heavy. (i.e diluted 6 times to make bupivacaine 0.42% and lignocaine 0.88%) (See Appendix-I)

Under all aseptic precautions, a 1inch 22G hypodermic needle for thin patients and 1.5 inch 22G needle for obese patients was inserted through the wheal and paresthesia elicited by the supraclavicular approach for a supraclavicular block. 20 ml of prepared local Anaesthetic mixture was injected after negative aspiration of blood. Paresthesia was elicited by low interscalene approach around 2.5 cm superior-medial to the previous point and 10 ml of bupivacaine 0.5% was injected for interscalene block. Care was taken so that the total dose of local anaesthetics did not exceed the maximum recommended dose. A gentle compression was given to ensure uniform spread of anaesthetic agent. Patients were sedated with pentazocine 15-30mg and diazepam 5-10mg in titrated doses. Immediately after the injection patients were asked about pain relief at fracture site. Sensory dermatome level of analgesia was checked with pin prick and motor weakness by hand grip and movement at the wrist, elbow and shoulder joints. Sensory analgesia and motor weakness was graded by Hollmen scale. A sensory and motor block of scale 3 was considered as endpoint. Duration of analgesia, additional analgesics used, sedation, adequacy of block and complications were noted.

Hollmen Scale 3

Sensory Block: 1 = normal sensation of pinprick, 2 = pin prick felt as sharp pointed but weaker compared with same area in the other upper limb, 3 = pin prick recognized as touch with blunt object, 4 = no perception of pin prick.

Motor Block: 1= normal muscle function, 2 = slight weakness in function, 3= very weak muscular action, 4 = complete loss of muscle action.

RESULTS

All patients had paresthesia on stimulation. Block was adequate in all patients (success rate 96.6%) except one where in intermittent analgesics were used in the form of i.v fentanyl and midazolam. Success rate was defined by percentage of patients where block alone was adequate for surgical Anaesthesia. The average onset of sensory analgesia of scale 3 was obtained in 2 min.30 sec ± 20 sec and motor block of scale 3 in 3 min.10 sec ± 20 sec. Duration of analgesia was defined by duration from injection of local Anaesthetic drug to first requirement of rescue analgesics. Analgesia lasted for a mean duration of 906 ± 217 minutes. Motor assessment of grade 2 was indicative of recovery from motor block. The mean duration of motor blockade was 732 ± 55 minutes. The mean duration of surgery was 160 ± 50 minutes.

None of the patients required supplementation with general Anaesthesia. None of the patients complained of breathing difficulty or had clinical evidence of accessory muscles of respiration being in action or a drop in saturation below 90%, suggestive of diaphragmatic palsy or pneumothorax. One patient had Horner's syndrome and one patient had hoarseness of voice which resolved without any intervention conservative management by about eight hours postoperatively.

DISCUSSION

Use of supraclavicular and infraclavicular block has been recommended for upper limb surgeries though this has been questioned.[4] Study report of Schroeder et al. showed 330 procedures for brachial plexus block, approach, technique and local Anaesthetic used. Adequate surgical Anaesthesia was present in 219 of 247 cases (89%), 46 of 59 cases (78%) in supraclavicular, 18 of 24 cases (75%) in interscalene block.

A transient episode of dyspnoea identifies the onset of phrenic palsy following a traditional interscalene brachial plexus block.[5] Pulmonary function tests usually show a mild restrictive process. The FVC is reduced from 20 to 30% of predicted and may decrease further in the supine position, occasionally leading to a reduction in oxygen saturation. The deleterious effect of the supine position is more pronounced with paralysis of the right hemidiaphragm because of the weight of the liver. Urmey et al.[6] showed that Interscalene block with 35-40 ml of mepivacaine 1.5% resulted in 100% incidence of hemi-diaphragmatic paresis and 27% decrease in FRC and FEV1. Decreasing the volume to 20 ml did not reduce the impairment.

A recent anatomic study showed that the phrenic nerve separates inferomedially from the brachial plexus 3 mm for each centimeter the nerve courses caudally.[7] On the basis of this anatomic separation, phrenic nerve blockade may be avoided by applying a restricted volume of a local Anaesthetic at a location caudal to C6. The study by Riazi et al.[2] using 5 ml and 20 ml Ropivacaine for classical interscalene brachial plexus block has shown reduction of hemidiaphragmatic paralysis from 100% to 49% in the low volume group. Our study gives the benefit of using low interscalene approach with no clinical evidence of decrease respiratory function, though no spirometry tests have been done to prove it. A case report of combination of Interscalene and supraclavicular block by Oren et al.[8] for a patient with end stage liver disease and severe pulmonary

dysfunction describes the use of combined technique with bupivacaine and mepivacaine without adverse respiratory effects.

Study by Kostadinova et al.[9] showed supraclavicular and interscalene block by inserting needle across interscalene approach and a catheter for supraclavicular spread gives 93% effective block with low rate of complications. Similar results have been observed in the present study with 96.6% success rate.

Bupivacaine 0.5% as sole agent is most commonly used as it gives a long duration of analgesia, albeit, with a slower onset of action compared to lignocaine or mepivacaine. Combination of lignocaine 5% (heavy) and bupivacaine 0.5 % has not been studied. The effect of lignocaine 5 % as neural toxic agent is reduced by diluting it to around 6 times with bupivacaine 0.5% resulting in a final concentration of lignocaine 0.88% and bupivacaine 0.42%. None of the patients had any evidence of nerve injury or motor weakness clinically, though no nerve study test was done to prove it.

The parameters of onset of sensory blockade, duration of analgesia (time to request of first additional analgesic) and duration of motor blockade were compared (Table-1). When the parameter of onset on analgesia was compared with literature, the combination used in the present study had the fastest onset time. Duration on analgesia was also more than comparable studies. This is attributed to using a mixture of bupivacaine and lignocaine as compared to bupivacaine alone. It have been shown that compounding of local anaesthetics as well as increasing their concentration increases the success rate as well as improving the block characteristics.[19] The total volume of drug as well as dosage of bupivacaine and lignocaine is also comparable with most studies.

The results of the present study demonstrate that administration of low interscalene block with supraclavicular block by the paresthesia technique with bupivacane 0.5% and lignocaine 5% heavy decreases the incidence of hemidiaphragmatic paresis and preserves respiratory function while providing excellent surgical anaesthesia and analgesia in upper limb surgeries especially shoulder surgery. The combination of bupivacaine 0.5% 20 ml and lignocaine 5% heavy 4 ml was studied in Neon Labs Ltd. Their reports showed that the mixture had a pH of 6.2 and is slightly hyperbaric compared to bupivacaine 0.5%. The lignocaine concentration became 8.917mg/ml (0.89%) (Appendix – I).

Use of combined interscalene and supraclavicular approach to block brachial plexus was found to be effective as a sole Anaesthetic technique with no respiratory

APPENDIX - I

**a) Total concentration per 4ml of Lignocaine hydrochloride = 53.3 x 4=213 mg /4ml*

b) Total concentration per 20ml of Bupivacaine hydrochloride = 5 x 20 =100mg/20ml

c) Total concentration per 24 ml after mixing a) & b)
Lignocaine hydrochloride = 213 mg/24ml = 8.883 mg /ml 0.88%)
Bupivacaine hydrochloride = 100mg/24ml= 4.167 (0.41%)

Table 2
Final concentrations of the local anaesthetics

	Lignocaine 5% heavy	Bupivacaine 0.5% without preservative	Mixture of 4ml of Lignocane 5% heavy with 20ml of Bupivacaine 0.5% without preservative
pH	6.2	5.9	6.2
Baricity	Hyperbaric 1.032	Isobaric 1.005	Hyperbaric 1.011
Concentration per ml	Lignocaine hydrochloride 53.3mg/ml	Bupivacaine hydrochloride 5 mg/ml	4ml of Lignocaine 5% heavy with 20 ml of Bupivacaine 0.5% without preservative Total volume becomes 24 ml *So the concentration per ml in mixture becomes Lignocaine Hydrochloride 8.883 mg/ml + Bupivacaine hydrochloride 4.167mg/ml

Table 1

	Block	Total Volume Injected	Bupivacaine Dose	Lignocaine use/dose	Onset time analgesia (min)	Duration analgesia (hrs)	Duration motor block motor (hrs)
Present study	IS + SC	30 ml	132 mg	Yes/176 mg	2.5 ± 0.3	15 ± 3.5	12.2 ± 1
Kothari D.10	SC	20 ml	30 mg	Yes/200 mg	3 ± 1	3.2 ± 0.2	2.2 ± 0.3
Kim BG et al.11	SC	30 ml	150 mg	Yes/200 mg	9.4 ± 2.3	8.6 ± 1.6	-----
Hickey R et al.12	SC	32 ml	160 mg	No	11 ± 7	13 ± 4	11 ± 4
Jadon A et al.13	SC	30 ml	90 mg	No	6.7 ± 1.2	5.5 ± 0.7	5.2 ± 0.4
Altinas F et al.14	IS	20 ml	100 mg	No	8.4 ± 5.9	9.2 ± 1.8	7.7 ± 2.3
Jarbo K et al.15	SC	30 ml	150 mg	No	20 ± 3.8	6 ± 1.4	.1 ± 1.1
Vagadia H et al.16	SC	30 ml	150 mg	No	11 ± 9	14 ± 6	11 ± 3
Klein SM et al.17	IS	30 ml	150 mg	No	4.2 ± 1.8	13 ± 8	-----
Fanelli G et al.18	IS	20 ml	100 mg	No	28 ± 15	10.9 ± 3.9	-----

compromise. It is of utmost importance in patients where general Anaesthesia is contraindicated. This combination can be used with the help of nerve stimulators and ultrasound technique to improve the accuracy and minimize chances of nerve injury.

Financial Interest: Declared by Authors as 'None'.

REFERENCES

1. Schroederl D., Horlocker T. The efficacy of axillary block for surgeries around elbow. Anesth Analg 1996; 83: 747-51
2. Riazi S., Carmichael N., Awad I. Effect of local Anaesthetic volume (20vs 5 ml) on the efficacy and respiratory consequences of ultrasound-guided interscalene brachial plexus block. Br J Anaesth 2008; 101: 549-56
3. Caponga G., Celleno D. Alkalization of local AnAesthetics. Which block, which Anaesthetics? Reg. Anesth 1995; 20: 369-77
4. De Tran QH, Clemente A, Doan J et al. Brachial plexus block: A review of approaches and techniques. Can J Anaesth 2007; 54: 662-74
5. Zoe D. D., Katerina M., Zakynthinos EG et al An unusual cause of dyspnea in a 77-year-old man. Chest 2004; 125; 770-4
6. William F U, Marianne M. Hemidiaphrag-matic Paresis during Interscalene Brachial Plexus Block. Anesth Analg 1992; 74:352-7
7. Kessler J, Schafhalter-Zoppoth I, Gray A. An ultrasound study of the phrenic nerve in the posterior cervical triangle: implications for the interscalene brachial plexus block. Reg Anesth Pain Med 2008; 33: 45–550
8. Oren T, Guttman, Soffer RJ et al. The ultrasound guided supraclavicular interscalene block- a case report. Pain practice 2008; 8: 62-4
9. Kostadinova R. Technique of supraclavicular brachial plexus block with interscalene approach for shoulder and arm surgery. Khiruugiia (sofiia) 2000; 56: 44-8
10. Kothari D. Supraclavicular Brachial Plexus Block: A new approach. Indian J Anaesth 2003; 47: 287-8
11. Kim BG, Lee IO, Kim NS et al. Clinical Evaluation of Supraclavicular Block with a Mixture of Local Anesthetics: Comparison of the Effect on Onset and Duration. Korean J Anaesthesiol. 1990; 23: 610-15
12. Hickey R, Hoffman J, Ramamurthy S. A comparison of Ropivacaine 0.5% and Bupivacaine 0.5% for brachial plexus block. Anaesthesiology 1991; 74: 639-42
13. Jadon A., Panigrahi M.R., Parida S.S. Buprenorphine Improves the Efficacy of Bupivacaine in Nerve Plexus Block: A Double Blind Randomized Evaluation in Subclavian Perivascular Brachial Block. J Anaesth Clin Pharm 2009; 25: 207-10
14. Altintas F, Gumus F, Kaya G. Interscalene Brachial Plexus Block with Bupivacaine and Ropivacaine in Patients with Chronic Renal Failure: Diaphragmatic Excursion and Pulmonary Function Changes. Anaesth Analg 2005; 100: 1166 –71
15. Jarbo K, Batra YK, Panda NB. Brachial plexus block with midazolam and bupivacaine improves analgesia. Can J Anesth 2005; 52: 822–26
16. Vaghadia H, Chan V, Ganapathy S et al. A multicentre trial of ropivacaine 7.5 mg/ml versus bupivacaine 5 mg/ml for supraclavicular brachial plexus Anesthesia. Can J Anaesth 1999; 46:946-51
17. Klein SM, Greengrass RA, Steele SM et al. A comparison of 0.5% bupivacaine, 0.5% ropivacaine, and 0.75% ropivacaine for interscalene brachial plexus block. Anaesth Analg 1998; 87:1316-9
18. Fanelli G, Casati A, Cappelleri G. et al. A clinical comparison of ropivacaine 0.75%, ropivacaine 1% or bupivacaine 0.5% for interscalene brachial plexus Anaesthesia. Eur J Anaesthesiol 1999; 16: 784-9
19. Jain PC, Kumar A, Chandralekha et al. Does compounding and increase in concentration of local Anesthetic agents increase the success rate of brachial plexus block? Indian J Anaesth 2002; 46: 193-6