

Original research article

Comparison of the efficacy of 0.5 percent levobupivacaine with a combination of 0.5 percent levobupivacaine and hyaluronidase, in ultrasound guided axillary brachial plexus block

¹Dr. Yogesh Magan Suryavanshi,²Dr. Prasad Madhavrao Sule,³Dr. Shraddha Kamal Mundra,⁴Dr. Mukesh Bharat Parmar

¹Associate Professor, Department of Anaesthesia, SMBT Institute of Medical Science and Research Center Dhamangaon, Nashik, Maharashtra, India

²Assistant Professor, Department of Anaesthesiology, Swami Ramanand Teerth Rural Govt Medical College, Ambajogai, Maharashtra, India

³Associate Professor, Department of Anaesthesiology, Rural Medical College, Pravara Institute of Medical Science, Loni, Maharashtra, India

⁴Assistant Professor, Department of Anaesthesia, SMBT Institute of Medical Science and Research Center Dhamangaon, Nashik, Maharashtra, India

Corresponding Author:
Dr. Mukesh Bharat Parmar

Abstract

Introduction: Axillary block is a regional anesthesia for surgeries at and below the elbow. Complications associated with peripheral blocks using blind approaches are addressed with advent of ultrasound guidance. Hyaluronidase drug works as a spreading factor. Combination of ultrasound guidance and hyaluronidase in addition to local anesthetics in peripheral blocks will increase efficacy and reduce complications. The aim and objective of the study is to compare the efficacy of 0.5% Levobupivacaine with a combination of 0.5% Levobupivacaine and hyaluronidase in USG guided axillary brachial plexus block for forearm and hand surgeries with respect to: Onset of sensory and motor block, duration of sensory block and time to rescue analgesia.

Keywords: Axillary brachial plexus block, hyaluronidase, levobupivacaine, sensory block, motor block

Introduction

Ultrasound imaging allows direct visualization of peripheral nerves, the block needle tip, and local anesthetic distribution. This imaging modality is highly useful for guiding targeted drug injections and catheter placement^[1]. The improved accuracy of 2 needle placement using ultrasound reduces the risk of complications and their costs associated with these procedures^[2]. Local Anesthetics are drugs that prevent conduction of electrical impulses on the membranes of nerve and muscle^[3]. They are classified into Aminoesters and Aminoamides. Levobupivacaine is an aminoamide local anesthetic. Adjutants are pharmacological drugs that when co-administered with local anaesthetic agents may improve speed of onset as well as the quality and duration of analgesia. Various additives can be added to local anesthetic for enhancing the peripheral nerve block^[4] like Epinephrine, Clonidine, Dexmedetomidine, Buprenorphine, Dexamethasone, Tramadol, Sodium bicarbonate and hyaluronidase. Hyaluronidase is widely used in ophthalmologic nerve blocks for better spread of the drug. It depolymerizes the mucopolysaccharide hyaluronic acid, a component of the mucoprotein substance or tissue cement. Hyaluronidase thereby renders the tissues more readily permeable to injected fluids (spreading effect) by increasing tissue membrane permeability and reducing the viscosity^[5]. The outcome is significantly

improved for most techniques in peripheral regional anaesthesia when direct ultrasonographic visualization is used. With the help of ultrasonography, the anaesthetist can directly visualize relevant nerve structures for all nerve blocks at all levels. Such direct visualization improves the quality of nerve blocks and avoids complications^[6].

Objectives

To compare the efficacy of 0.5% Levobupivacaine with a combination of 0.5% Levobupivacaine and hyaluronidase in USG guided axillary brachial plexus block for forearm and hand surgeries with respect to onset of sensory block, onset of motor block, duration of sensory block and time to rescue analgesia.

Materials and Methods

An observational prospective study was carried out among 60 adult patients in the age group of 18-60 years belonging to ASA PS 1 and 2 scheduled to undergo elective upper limb orthopedic procedures in the orthopedic theatre. The study was conducted from January 2016 to October 2017. All the patients were assessed and those with normal clinical, hematological, biochemical and radiological parameters were selected. Informed written consent was obtained from all the patients and they were alternately assigned to two groups Group A and Group B each containing 30 patients.

Group A: Patients undergoing Ultrasound guided Axillary Brachial plexus block with 20 ml of 0.5% Levobupivacaine and Hyaluronidase 300 Units (15U/ml of local anesthetic)

Group B: Patients undergoing Ultrasound guided Axillary Brachial plexus block with 20 ml of 0.5% Levobupivacaine.

American Society of Anesthesiology Physical status Class 1 (A normal healthy patient) and Class 2 (A patient with mild systemic illness and weight 40 to 80kg alone were included in the study. Any patient with history of bleeding disorders, documented neuromuscular disorders, known allergy to Local anesthetics drugs, Psychiatric patients and if on anticoagulants were excluded from the study. Considering the mean sensory block onset time as around 13.8 minutes in the treatment group⁽⁷⁾ and expecting a difference of 5 to 6 minutes from the control group, using a standard error of 6 the required sample size was calculated to be 30 in each group.

The following parameters were observed following the block

Hemodynamic parameters like pulse rate, non-invasive blood pressure, oxygen saturation were monitored. Mean arterial blood pressure (MAP) and pulse rate (PR), oxygen saturation were recorded before application of the block as well as immediately after block & 3 min intervals until the end of the operation. Any drop in blood pressure more than 20% from the baseline signifies hypotension and was managed with Inj.ephedrine 6 mg. Any decrease in pulse rate of less than 60 beats/min was managed with Inj.atropine 0.6mg. Sensory block was tested with a 22-gauge hypodermic needle by using the pinprick test and compared with the same stimulation in the contralateral hand. Sensory block was evaluated by the pinprick method in the nerve distribution of the radial nerve (dorsum of thumb), ulnar nerve (palmar aspect of fifth finger), median nerve (palm of the hand) and musculocutaneous nerve (lateral aspect of forearm). A three-point scoring system was used: 2=normal sensation; 1=impaired sensation; 0=loss of sensation. Onset of Sensory Block^[8] was defined as the time between the end of last injection and the total pinprick response score of 0 over hand and forearm. Motor block was assessed in the nerve distribution of the radial nerve (wrist extension), ulnar nerve (adduction of fourth and fifth finger), median nerve (flexion of the distal phalangeal joint on the second finger) and musculocutaneous nerve (flexion of the elbow), with the following scoring: 2=normal motor function; 1=impaired motor function; 0=no motor function. Onset of motor blockade^[8] was defined as the time taken from the injection of drug to development of total block score of 0.37. Duration of sensorial block (minute) was recorded as Time interval between withdrawal of the needle and reappearance of paresthesia in the 4 nerve distribution areas. First analgesic requirement time (minute) i.e., Rescue analgesia is defined as the time interval between block placement and patient's first analgesic request. Postoperatively pain scores were recorded by using visual analogue score^[9] between 0 to 10 (0=no pain, 10= most severe pain). Rescue analgesia was given at VAS score of 4 or above.

Observation and Results

The following observations were made and data were collected using a structured questionnaire Sex, Age, Weight, Height, ASA physical status, Pulse rate, blood pressure, Oxygen saturation at 5 min intervals until 30 min, then at 1 hour, thereafter every hour till 12 hours were documented along with

onset time of sensory block, onset time of motor block, duration of sensory blockade, duration of analgesia and any untoward side effects. Data were analyzed using SPSS16.0V software. Means were calculated for descriptive analysis. Two sided independent students t test was used to analyze continuous data and chi square test for categorical data. P value <0.05 was considered as statistically significant.

Demographic data

The mean age of the participants in group A was 44.9 ± 13.6 and in group B was 43.4 ± 16.2. The mean height in group A and B were 164.8±8.7 cms and 164.5 ± 8.5 cms respectively. The mean weight in group A was 66.8±6.0 Kg and in group B was 64.8 ± 6.7 Kg. 83.3% of participants in both the groups were in ASAPS grade 1. The two groups were comparable with respect to their age and sex. There was no statistically significant difference among two groups in demographic profile.

Table 1: Comparison of sex between Group A and Group B

Sex	Group A (Levobupivacaine and hyaluronidase)		Group B (Levobupivacaine)	
	Count	Percent	Count	Percent
Male	15	50.0	17	56.7
Female	15	50.0	13	43.3

Table 2: Comparison of age between Group A and Group B

Age	Group A (Levobupivacaine and hyaluronidase)	Group B (Levobupivacaine)
	Count	Count
18-20	2	7
20-29	5	2
30-39	5	1
40-49	3	9
50-59	7	5
>=60	7	6
Mean ± SD	44.9 ± 13.6	43.4 ± 16.2

Table 3: Comparison of height between Group A and Group B

Group	Mean Height (cm)	SD	N	t value	P
Group A (Levobupivacaine and hyaluronidase)	161.8	8.5	30	1.03	0.302
Group B (Levobupivacaine)	159.5	8.4	30		

Table 4: Comparison of weight between Group A and Group B

Group	Mean weight (Kg)	SD	N	Tvalue	P
Group A (Levobupivacaine and hyaluronidase)	62.72	6.32	30	1.19	0.21
Group B (Levobupivacaine)	66.65	6.72	30		

Table 5: Comparison of ASA PS between Group A and Group B

ASA PS	Levobupivacaine and hyaluronidase	Levobupivacaine	χ ²	P
	Count	Count		
Grade I	25	25	0	1.000
Grade II	5	5		

Table 6: Comparison of Oxygen saturation between Group A and Group B

Intraoperative	No of cases	Mean ±S.D(%)	P value
Group A	30	99±0.0041	
Group B	30	99±0.0029	
Postoperative	No of cases	Mean±S.D	
Group A	30	100±0.00	0.9602

Group B	30	99±0.002	
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Table 7: Comparison of pulse between Group A and Group B

	Mean(min)	S.D	P value
Group A	81.82	1.69	0.343
Group B	81.92	1.599	

Table 8: Comparison of Mean arterial pressure between Group A and Group B

	Mean(mm/Hg)	S.D	P value
Group A	104.2	2.71	0.891
Group B	103.01	1.92	

Discussion

The popularity of peripheral nerve blocks grew because it decreases pain postoperatively, reduces incidence of nausea, decreases need for post-operative analgesics, shortens post anesthesia care time, and most importantly increases patient satisfaction^[10, 11, 12]. Multimodal perioperative care pathways designed for enhanced recovery achieve early recovery after surgical procedures by maintaining preoperative organ function and reducing the stress response following surgery. One key component of such enhanced recovery protocols is standardized analgesic and anesthetic regimens. Peripheral nerve blocks in particular help in enhanced recovery of the patient by the possibility of early mobilization of the patient^[12, 13, 14]. Early in the history of anesthesia, peripheral nerve block techniques were developed. The American surgeons Halsted and Hall described the injection of cocaine into peripheral sites for minor surgical procedures in 1884^[15]. Axillary block was first described by Hirschel in 1911^[16], but it gained popularity only after Burnham’s publication in 1959^[17]. With years of modification and development, the technique and concept of axillary block has improved. Brachial plexus (C5-T1) blockade will allow for surgical anesthesia of the upper extremity and shoulder. The Brachial plexus can be blocked at various levels from the roots to the terminal branches-Interscalene block, Supraclavicular block, Infraclavicular block, Axillary block and peripheral blocks at the Midhumeral level, elbow and wrist^[18]. Axillary brachial plexus block is popular because of its ease, reliability and safety^[19]. Nerves blocked are the terminal nerves. Indications for axillary block include surgery at and below elbow; forearm and hand^[20].

Conclusion

In ultrasound guided axillary brachial plexus block using 0.5% levobupivacaine, addition of 15 units of hyaluronidase per milliliter of levobupivacaine (300 units in 20 ml) reduces onset of sensory and motor block time therefore shortens the total anaesthetic time before the operation. It also reduces the duration of post-operative sensory block time and time to requirement of rescue analgesia.

References

1. Andrew T. Gray: Ultrasound-guided Regional Anesthesia: Current State of the Art Anesthesiology 2006;104:368-373.
2. Mercaldi CJ, Lanes SF. Ultrasound guidance decreases complications and improves the cost of care among patients undergoing thoracentesis and paracentesis. Chest. 2013 Feb;143(2):532-538.
3. Charles B. Berde. Miller’s textbook of anesthesia: Chapter 36, 10-29.
4. Bailard NS, Ortiz J, Flores RA. Additives to local anesthetics for peripheral nerve blocks: Evidence, limitations, and recommendations. 2014 Mar;71(5):373-85. Doi: 10.2146/ajhp130336.
5. Bettina Alexandra Buhren, Holger Schrupf. Hyaluronidase: from clinical applications to molecular and cellular mechanisms European Journal of Medical Research. 2016;21:5.
6. ACapek, et al. Ultrasound-guided peripheral nerve blocks of the upper limb Continuing Education in Anaesthesia Critical Care & Pain. 2015 June;15(3):160-165.
7. Carli F, Kehlet H, Baldini G, Steel A, McRae K, Slinger P, et al. Reg. Anesth Pain Med. 2011 Jan-Feb;36(1):63-72.
8. Harold Ellis. Textbook of Ellis anatomy for anesthetist. Part 4, 153.
9. Chan VW, Can J, et al. Ultrasound guidance improves success rate of axillary brachial plexus block. Anaesth. 2007 Mar;54(3):176-82.
10. Paul JE, et al.: Anesthesiology. 2010;113:11-44.
11. Carli F, Clemente A. Regional anesthesia and enhanced recovery after surgery. Minerva Anestesiologica. 2014 Nov;80(11):1228-33.

12. AbdelazeemEldawlatlySaudi J Anesthesiology 2016 Apr-Jun;10(2):119-120.
13. Hall RJ: N Y med J. 1884;40:643.
14. HirschelG. Anesthesiaofthebrachialplexus foroperationsonthe upper, München Med Wochenschr. 1911;58:1555-1556.
15. BurnhamPJ. Simple regional nerve block for surgery ofthehandandforearm, Journal of the American Medical Association. 1959;169(9):941-943.
16. Treses T Horlocker, *et al.* Peripheral nerve blocks. Miller's textbook of anesthesia: Chapter 57, 17-30.
17. De Jong RH. Axillary block of the brachial plexus. Anesthesiology. 1961;22:215.
18. Schroeder LE, *et al.* The Efficacy of Axillary Block: Anesth Analg. 1996 Oct;83(4):747-751.
19. Koh WU, Min HG, Park HS, Karm MH, Lee KK, Yang HS, *et al.* Use of hyaluronidase as an adjuvant to ropivacaine toreduce axillary brachial plexus block onset time: a prospective, randomised controlled study. Anaesthesia. 2015 Mar;70(3):282-9.
20. Sarvela J, *etal.*Hyaluronidase improves regional ophthalmic anaesthesia with etidocaine. Can J Anaesth. 1992 Nov;39(9):920-4.