ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

Comparison of fentanyl and buprenorphine added to local anesthetics as adjuvants in brachial plexus block through axillary approach using ultrasound guidance -A randomized clinical trial

Corresponding Author: - **AUTHORS**

1)Dr Pratibha S.D[1] , Associate Professor
Department Of Anaesthesiology BLDE Deemed to be university Shri B.M. Patil Medical College and Hospital ,Vijayapur-586103
Email- pratibhakaradi@gmail.com mobile no-9036110082

2) Dr Sumedha R Bhat[2], Junior Resident
Department of Anaesthesiology, B.L.D.E (Deemed to be University) Shri B M Patil Medical College and Hospital, Vijayapur- 586103 (Karnataka) India
Email- sumedharbhat910@gmail.com mobile no - 9482816117

3)Dr. Shivanand .L. K[3] , Professor
Department Of Anaesthesiology BLDE Deemed to be university Shri B.M. Patil Medical College and Hospital ,Vijayapur-586103
Email; shivanandkarigar82@gmail.com
Mobile no-9164319345

4)Dr Renuka Holyachi[4], Professor and Head of department
Department Of Anaesthesiology BLDE Deemed to be university Shri B.M. Patil Medical College and Hospital ,Vijayapur-586103
Email: renuka312@gmail.com mobile no- 9886492178

Dr. Pratibha.S.D
Associate professor,
Department of Anesthesiology,
B.L.D.E (Deemed to be university), Shri B M Patil Medical College, Hospital & Research Centre,Vijayapura, Karnataka - 586103.
Email: pratibhakaradi@gmail.com

Phone number: 9036110082

ABSTRACT

Introduction -

The axillary brachial plexus block is a frequently used regional anaesthetic technique for procedures on the elbow, forearm, and hands. This technique avoids the adverse effects of the other brachial plexus block techniques such as cervical sympathetic nerve blockade, pneumothorax and diaphragmatic paresis. This study compared the effectiveness of local

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

anaesthetics with fentanyl and buprenorphine for ultrasound-guided brachial plexus block using an axillary approach.

Methods –

This Prospective randomised study was conducted on 60 patients ASA I & II who underwent forearm, wrist and hand surgeries. 30 Patients in each group. Group A received 50 micrograms fentanyl and the Group B received 0.3 mg buprenorphine as adjuvants to ultrasound guided axillary brachial plexus block. Onset, time to achieve and duration of sensory and motor blockade were noted.

Results –

Group B achieved a faster onset of sensory and motor block than Group A. Group B had complete sensory and motor block earlier than Group A. Group B had prolonged duration of sensory and motor block than Group A.

Conclusion -

Buprenorphine added to local anaesthetics has early onset, shorter time to achieve complete sensory and motor block, prolongs the duration of analgesia compared to fentanyl in axillary brachial plexus block by using ultrasound.

KEY WORDS: Fentanyl, Buprenorphine Axillary brachial plexus block, ultrasonography

INTRODUCTION

The technique of brachial plexus block through axillary approach was first described by William S. Halstead in 1884. This technique became popular as it was easy, reliable and safe. For procedures involving the elbow, forearm, and hands, this regional anaesthetic method is frequently employed. The potential side effects of the other brachial plexus block approaches, such as cervical sympathetic nerve blockade, pneumothorax and diaphragmatic paresis are not present in this method.(1,2) It offers greater analgesic effect and reduces the adverse effects of general anaesthesia, making it beneficial for patients with substantial comorbidities such as respiratory and cardiovascular disorders/ (3)

Standard anaesthesia technique worldwide includes peripheral nerve blocks and avoiding opioids for its side effects when used as an analgesic. Unfortunately local anaesthetic duration of analgesia is limited. So adjuvants are mixed with local anaesthetics to enhance their effectiveness, delay the onset of localised blocking, and extend the duration of postoperative analgesia.(4).The purpose of this study was to evaluate the effectiveness of

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

local anaesthetics and fentanyl and buprenorphine in ultrasound guided brachial plexus block using an axillary approach.

MATERIALS AND METHODS

After obtaining approval from Institutes Ethical Committee (Project No- IEC/286/2018) this prospective randomized clinical study was carried out over a period of one and half year from December 2018 to August 2020. A total of 60 patients 18-60years of age ,either gender, belonging to American Society of Anaesthesiologists(ASA) Status I and II posted for forearm, wrist and hand surgeries were enrolled for the study. Patient refusal,local anesthetic allergy, injection site infection,bleeding disorders, coagulopathies, pre-existing neuropathies were excluded from the study.

Sample Size:

With Anticipated Mean Difference of mean duration of analgesia between the study groups as 205.36 min and Anticipated SD as 1800.1 min the minimum sample size per group is 27 ($\approx$30) With 95% power and 1% level of significance [(4)].

Total sample size was 60

Sixty patients in the study were matched for age, gender and weight. They were then randomly chosen and divided into two groups of 30 patients each using computer-generated random number tables.

In all the patients selected for study pre anaesthetic evaluation was done which included history, general physical examination, airway assessment, laboratory investigations, chest x ray, ECG and echocardography depending on the patient requirements. Written informed consent was taken from the patient for participaton in the study. Pre operative fasting guidelines were followed. Monitoring included pulseoximetery, NIBP, ECG and baseline values were recorded. IV line was secured on non operative limb with 20 Gauge iv cannula. Premedicaton was given with intravenous inj. Glycopyrrolate 0.01mg/kg, inj. Midazolam 0.05mg/kg and inj. Ondansetron 0.15 mg/kg. Patient in supine position with the operating arm abducted and head is turned to the opposite side. Aseptic precautions were followed. The axillary artery was palpated and marked at the skin site. Sterile gel was applied to the ultrasound probe and probe covered by sterile cover. Sonosite M turbo, linear probe which is of high frequency of 13-6 MHz was used.

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

The Ultrasound probe was placed over axilla and axillary artery and vein was visualized. Axillary artery is surrounded by terminal branches of brachial plexus , median nerve, ulnar nerve and radial nerve. .Under direct ultrasound visualisation, the needle was placed superior to the transducer and progressed inferiorly towards the plexus. Local anaesthetic was injected around each nerve after aspiration.

Group A was administered lignocaine 2% with adrenaline 10ml and bupivacaine 0.5% with Fentanyl 50microgram 10ml

Group B was administered lignocaine 2% with adrenaline 10ml and bupivacaine 0.5% with buprenorphine (0.3mg) 10ml.

Hollmen scale is used to evaluate sensory block after completion of LA injection.

The scores are:

[1] = Sensation of pin prick felt normally

[2] = Pin prick sensation was felt but it was weaker than in other upper limbs

[3] = Pin prick felt as touch with blunt item

[4] = No perception of pin prick.

The Hollmen Score of 4 indicates a total sensory block. The scores are recorded every two minutes until that point.

The time interval in minutes from the local anaesthetic injection till the beginning of the sensory block (Hollmen score > 1) was used to determine the onset time of the block.

The duration required for achieving a complete sensory block was calculated by measuring the time from the local anaesthetic injection until the desired result was obtained (Hollmen Score = 4).

The duration of the sensory block was defined as the interval between the time for complete sensory block and the time in the postoperative period at which the Hollmen score was less than 4.

The Modified Bromage Scale for the Upper Extremity on a 3-point scale was used to assess the motor block.

Grade 0 - normal motor function till full extension of elbow, wrist and fingers.

Grade 1 - decrease motor strength with ability to move fingers and or wrist

Grade 2 - complete motor blockade with inability to move fingers.

Time of onset of motor block i.e modified bromage score=1 and time for complete motor block i.e modified bromage score=2 were recorded in all cases. The peripheral nerve

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

blockade was considered to be failed or inadequate and cases excluded from the study if patient complained pain even after 30 minutes after peprformance of block and general anaesthesia was planned.

Adverse events such as vascular damage, haemorrhage, nausea, vomiting, dyspnea, decrease in respiratory rate or oxygen saturation, any indication of LA toxicity, ECG abnormalities, drowsiness, etc, were monitored for all patients.

Postoperatively, pain was assessed using visual analogue scale which has 10 cm line, pain score between 0 (no pain) to 10 (severe pain) were marked by the patients. When patients complaint of pain (i.e. VAS>4), Inj Paracetamol 1g IV was given.

The data obtained was reprsented as mean and standard deviation, percentage and numbers. Student t-test was used for parametric data. Chi square test and Fishers exact test were used for non parametric data. A p-value of <0.05 was considered statistically significant. Data was analysed using SPSS software.

RESULTS

Patients in both the study groups in terms of age, weight and gender distribution were comparable (Table 1). In Group B onset time of sensory block(2.8±0.6 mins) (Mean ± S.D), and onset time of motor block (4.7±0.8 mins) was earlier when compared to Group A with onset time of sensory block (4.4±0.8 mins), and onset time of motor block (6.9±1.4 mins) which is statistically significant (p value being <0.05)

In Group B Time to achieve complete sensory block (8.2±0.8 mins), and time for complete motor block was 11.2±1.0 mins was faster when compared to Group A with time for complete sensory block was 11.0±0.8 mins, and time for complete motor block was 14.0±1.2 mins which is statistically significant (p value being <0.05).

In Group B total duration of sensory block (277.3±9.8 mins), and total duration of motor block was (310.0±9.9 mins) was prolonged when compared to Group A with total duration of sensory block was 230.5±11.3 mins, and total duration of motor block was 256.3±14.5 mins (Table 2). There were no cases of failed blocks in either of the study groups. In Group B 3 patients complained of nausea and vomiting with p value of 0.076 which is statistically not significant and in the perioperative period there were no serious adverse effects observed in any of the groups.

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

DISCUSSION

Brachial plexus block is ideal anesthetic technique for upper limb surgeries and used routinely. The axillary approach to the brachial plexus block is relatively safer and easier to perform compared to supraclavicular and interscalene techniques. By introducing Ultrasound guidance in clinical practice peripheral nerves can be identified and it has the potential benefit of optimising the spread of the local anesthetic solution around the nerves under sonographic vision.[5]

By using ultrasound guided peripheral nerve blocks, anesthesiologists can improve the quality of the nerve block by securing a precise needle location and tracking the local anesthetic's distribution in real time. [6,7,8,9,10]

In an axillary brachial plexus block, Nishikawa K et al [11]used 100 µg of fentanyl in 40 ml of 1.5% lidocaine with 1:2,000,000 epinephrine. They hypothesised that the slower rate of analgesia onset is caused by a slower rate of nerve penetration of lignocaine, since the pH of lignocaine decreased from 6.2 to 5.2 after adding 100 µg of fentanyl

Sarkar D [4] conducted study in which fentanyl and buprenorphine were added in supraclavicular block. The improvement in blockade characteristics was evaluated. In this study they found buprenorphine group had early time of onset of sensory block and motor block , the time for the complete sensory block and the complete motor block was less in buprenorphine group with prolonged duration of analgesia and minimal incidence of nausea and vomiting, no obvious side effects observed in hemodynamic and respiratory parameters.

In a supraclavicular approach, Candido et al [12] and Dixit R assessed the effectiveness of adding buprenorphine to local anaesthetic for brachial plexus block. They found that in 75% of the patients, the addition of buprenorphine resulted in a three-fold increase in postoperative analgesia duration, with complete analgesia lasting for 30 hours and longer than the duration provided by local anaesthetic alone.

When comparing the effects of bupivacaine alone with bupivacaine plus buprenorphine in axillary block, Sanghvi KS [14] found that the addition of buprenorphine considerably prolonged sensory block and lengthened the duration of analgesia.

In a study by Jadon A [15]he observed the effectiveness of combining buprenorphine with bupivacaine in subclavian perivascular brachial block. He found that adding 3 µg/kg of buprenorphine to 0.3% bupivacaine for perivascular brachial block in upper limb orthopaedic surgery improved the block's quality and prolonged its duration.

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

In group B three patients complained of nausea and vomiting and were treated with inj ondansetron 0.15mg/kg and in the perioperative period complications were not observed in any group.

CONCLUSION

Buprenorphine added to local anaesthetics has early onset, shorter time to achieve complete sensory and motor block, prolongs the duration of analgesia compared to fentanyl in axillary brachial plexus block by using ultrasound.

References

1) Paramaswamy R, Mahipath SR, Durairaj AR, Sundaramurthy N. Comparison of Dexamethasone and Ketorolac as an Adjuvant To Bupivacaine in Axillary Brachial Plexus Blocks for Isolated Hand and Forearm Injuries: A Randomised Double-Blind Prospective Study. J Clin & Diagn Res. 2018 Jan 1;12(1).

2) Brown AR. Anaesthesia for procedures of the hand and elbow. Best Pract Res Clin Anaesthesiol. 2002 Jun 1;16(2):227-46.

3) Fatma Gad El-rab Askar, Nawal Abdel Azeez Gad El-rab, Hatem Hassn Mohammed Maghraby, Waleed Al Araby Ahmed, Khaled Abdel-Baky Abdel-Rahman, Asmaa M Moatasem. Fentanyl as an adjuvant to bupivacaine in infraclavicular brachial plexus block. International journal of multidisciplinary research and development: Jan 2017;(4):121-3

4) Sarkar DJ, Khurana G, Chaudhary A, Sharma JP. A comparative study on the effects of adding fentanyl and buprenorphine to local anaesthetics in brachial plexus block. J Clin Diagn Res. 2010;4(6):3337-43.

5) Soeding PE, Sha S, Royse CF, Marks P. A randomized trial of ultrasound-guided brachial plexus anaesthesia in upper limb surgery. Anaesth Intensive care. 2005 Dec 1;33(6):719-25.

6) Kumar A, Sharma D, Sibi ME, Datta B, Gogoi B. Comparison of peripheral nerve stimulator versus ultrasonography guided axillary block using multiple injection technique. Indian J Anaesth. 2014 Nov;58(6):700.

7) Marhofer P, Greher M, Kapral S. Ultrasound guidance in regional anaesthesia. Br J Anaesth. 2005 Jan 1;94(1):7-17.

8) Grau T. Ultrasonography in the current practice of regional anaesthesia. Best Pract Res Clin Anaesthesiol. 2005 Jun 1;19(2):175-200.

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

9) Koscielniak‐Nielsen ZJ. Ultrasound‐guided peripheral nerve blocks: what are the benefits?. Acta Anaesthesiol Scand. 2008 Jul;52(6):727-37.

10) Williams SR, Chouinard P, Arcand G, Harris P, Ruel M, Boudreault D, Girard F. Ultrasound guidance speeds execution and improves the quality of supraclavicular block. Anesth Analg. 2003 Nov 1;97(5):1518-23.

11) Nishikawa K, Kanaya N, Nakayama M, Igarashi M, Tsunoda K, Namiki A. Fentanyl improves analgesia but prolongs the onset of axillary brachial plexus block by peripheral mechanism. Anesth Analg. 2000 Aug 1;91(2):384-7.

12) Candido KD, Franco CD, Khan MA, Winnie AP, Raja DS. Buprenorphine added to the local anesthetic for brachial plexus block to provide postoperative analgesia in outpatients. Reg Anesth Pain Med. 2001 Jul 1;26(4):352-6.

13) Dixit R, Chakole V, Tadwalkar GV. Effect of buprenorphine on post operative analgesia in supraclavicular brachial plexus block using peripheral nerve locator. Journal of Evolution of Medical and Dental Sciences. 2013 Jan 14;2(2):114-9.

14) Sanghvi KS, Shah VA, Patel KD. Comparative study of bupivacaine alone and bupivacaine along with buprenorphine in axillary brachial plexus block: a prospective, randomized, single blind study. Int J Basic Clin Pharmacol. 2013;2(5):640-4.

15) Jadon A, Panigrahi MR, Parida SS, Chakraborty S, Agrawal PS, Panda A. Buprenorphine improves the efficacy of bupivacaine in nerve plexus block: A double blind randomized evaluation in subclavian perivascular brachial block. J Anaesthesiol Clin Pharm. 2009 Apr 1;25(2):207-10

Tables

Table 1: Demographic data of patients

Parameters	**Group A**	**Group B**	**P Value**
Age (Mean ± SD)	39.3± 14.6	39.7± 13.1	0.926
Male N(%) **Female N(%)** **Total**	22(73.3%) 8(26.7%) 30(100%)	20(66.7%) 10(33.3%) 30(100%)	0.573
Weight	60.5±9.1	60.6± 8.7	0.977

ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

(Mean ± S.D)			

p value <0.05 is taken as significant

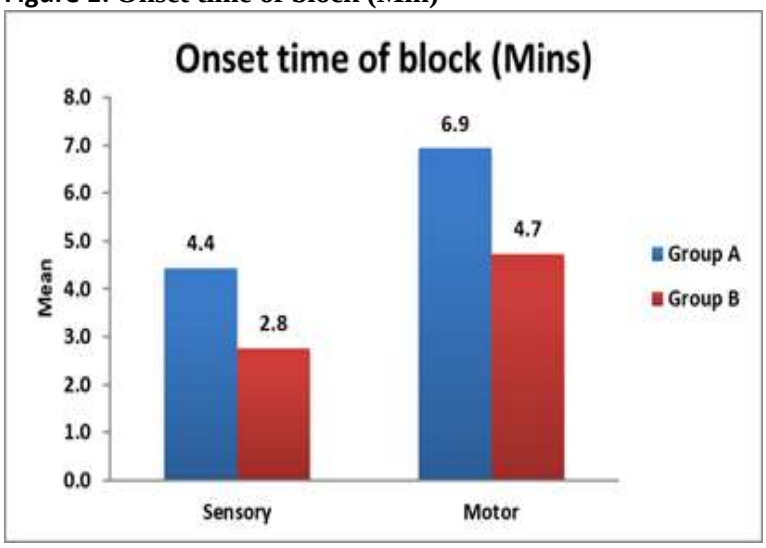
Table 2: Axillary Block parameters (Min)

Data	Group A Mean±SD	Group B Mean±SD	P value
Onset time of block			
Sensory	4.4±0.8	2.8±0.6	<0.001*
Motor	6.9±1.4	4.7±0.8	<0.001*
Time to achieve complete block			
Sensory	11.0±0.8	8.2±0.8	<0.001*
Motor	14.0±1.2	11.2±1.0	<0.001*
Total duration of block			
Sensory	230.5± 11.3	277.3±9.8	<0.001*
Motor	256.3±14.5	310.0±9.9	<0.001*

Note: * significant at 5% level of significance

Graphs

Figure 1: Onset time of block (Min)



ISSN:0975-3583,0976-2833 VOL15,ISSUE05,2024

Figure 2: Time to achieve block (Min)

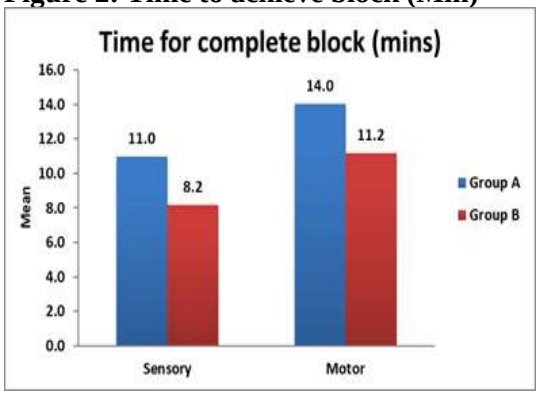


Figure 3: Total duration of block (Min)