Original Research Article

Axillary brachial plexus block with midazolam as an adjuvant to local anesthetics

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Abstract

Background: Brachial plexus block (BPB) has long been regarded as a safe alternative to general anesthesia in upper-limb treatments. Opioids, clonidine, neostigmine, hyaluronidase, bicarbonate, and dexamethasone are examples of adjuvant drugs that have been shown to improve clinical and pharmacologic effects. The purpose of this randomized clinical trial is to assess how effective midazolam is as a bupivacaine adjuvant **Aims:** The purpose of this study was to compare the axillary block with bupivacaine alone and bupivacaine-midazolam combination in terms of onset, duration, and postoperative pain levels. **Methods And Material:** After receiving clearance from the Institutional Ethical Committee and signed informed consent from the patients, we enrolled 70 ASA I or II adult patients scheduled for upper limb procedures in our study **Results:** The onset of sensory block took 10.6 ±1.48 minutes in group 2 compared to 20.2 ±2.41 minutes in group 1. In group 2, the start of the motor block was 12 ± 1.55 minutes, compared to 22.08 ± 2.58 minutes in group 1. The results were statistically significant (p-value less than 0.0001) **Conclusions:** When 30 mL of 0.5% bupivacaine is mixed with midazolam, the start of sensory and motor blockade is improved, the duration of sensory and motor blockade is prolonged, and the postoperative analgesia is improved without any negative side effects

Key-words: Brachial plexus block, Sensory and motor block, Midazolam, Bupivacaine, Analgesia

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INTRODUCTION

William Halsted initially demonstrated the axillary approach to the brachial plexus in 1884 when he injected cocaine under direct vision.[1] The brachial plexus is created from the ventral rami of the lower four cervical nerves and the first thoracic nerve, and it delivers nerve supply to the upper limb. Roots, trunks, divisions, and cables make up this structure. Compression of nerve trunks (nerve ischemia) or application of freezing temperature (cryoanalgesia) was used as a form of regional anesthesia in the past. Such tactics were utilized by the Romans, who learned them from Assyrian monks and revived them by Moore. Ruggieri utilized them in Italy. Any adjuvant to brachial block should either prolong analgesia without causing systemic side effects or prolong motor block while lowering the overall local anesthetic dose. Bupivacaine is the most commonly used local anesthetic for brachial plexus block because of its long duration of action.[2] Exstam and colleagues developed bupivacaine in 1957, and Telivio utilized it for the first time in 1963. Bupivacaine can produce central nervous system toxicity, which can range from dizziness and lightheadedness to generalized convulsions and global CNS depression. Various medications added to the local anesthetic as adjuvants have been found to have clinical and pharmacologic benefits.[3-5] Adjuvant medicines such as alpha-2 adrenoreceptor agonists and opioids have been extensively researched.[6-8] Opioids, clonidine, neostigmine, hyaluronidase, bicarbonate, and dexamethasone have all been examined as adjuvants.[9] Midazolam, an imidazobenzodiazepine derivative, is a water-soluble benzodiazepine that is used as a premedicant, sedative, and

induction agent for anesthesia. When given in neuraxial block, it is known to promote antinociception and amplify the impact of local anesthetic. It achieves this effect by acting on Gamma-Aminobutyric Acid-A (GABA-A) receptors, which are found in peripheral neurons.[10-15] In 1976, Freyer and Walser developed the medication.[16,17] Using different methodologies, Lenon EL *et al.*[18] and Lanz E. *et al.*[19] investigated the extent of blockage quantitatively in order to determine the optimal way to utilize it for various surgical procedures. Motor blockade develops faster than sensory blockade in all techniques. They proposed that the site of operation should dictate the technique used, as follows:

1. The Interscalene technique is used in clavicle, shoulder, and arm surgery.
2. For surgeries involving the upper arm, elbow, forearm, and radial aspect of the hand, the supraclavicular and subclavian procedures are used.
3. The axillary approach is ideally suited for forearm and hand surgery.

The goal of this study was to compare the onset time, duration of motor and sensory block, and analgesic efficacy of midazolam bupivacaine to plain bupivacaine (0.5%) for brachial plexus block via the axillary route to plain bupivacaine (0.5%).

MATERIAL AND METHODS

The Department of Anesthesiology at G.R. Medical College and the J.A. Group of Hospitals in Gwalior (M.P.) undertook a randomized controlled clinical trial. 70 ASA I or II adult patients of either sex between the ages of 16 and 65 who were scheduled for forearm and hand surgery after trauma were included in the study after acquiring Institutional Ethical Committee approval and written informed consent. Patients with a history of local anesthetic hypersensitivity, infection at the injection site, severe hypertension, myocardial infarction, bleeding tendencies, neurological disease, respiratory, hepatic, renal, and endocrine disease, multiple injuries, and uncooperative patients were excluded from the study. Patients were split into two groups at random: group A (n=35) and group B (n=35). Prior to the surgery, intradermal sensitivity to bupivacaine hydrochloride was tested in the wards. Before the operation, all of the patients were maintained nil orally for 6 hours. The "Axillary-block position" was used on the patients. The lower end of the arm was then secured with a pneumatic tourniquet, and the pressure in the cuff was raised to 60 mmHg above the systolic blood pressure. At the highest point of the axilla, a 22-G, 4-cm "short beveled" needle was inserted at a 30o angle, parallel to, and just above the artery until paresthesia was evoked. The research drug was injected after evoking paresthesia and a negative blood aspiration. Patients in group A received 30 ml of 0.5 percent bupivacaine, while patients in group B received 30 ml of 0.5 percent bupivacaine plus 50 g kg–1 of midazolam. Patients were examined for sensory blockade by putting spirit-soaked cotton on skin dermatomes to measure the temperature every minute from the moment the test medication was injected until the block was achieved. Thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and elbow flexion in supination and pronation of the forearm were used to determine motor blockage (musculocutaneous nerve). A visual analog score scale was used to quantify postoperative pain, which consisted of a 100 mm horizontal scale with gradations ranging from '0' to '10', with '0' indicating no pain at all and '10' indicating terrible agony.

Statistical Analysis:

The data from both groups were collated, and statistical analysis [20] was performed using the Chi-Square test and the student's test (paired for intragroup comparison and unpaired for intergroup comparison). A statistically significant P-value of 0.05 was considered statistically significant, while a very significant P-value of 0.001 was considered extremely significant.

RESULTS

A total of 70 patients met the criteria for inclusion. They were allocated into two groups of 35 people each at random. There were no significant variations in mean age, gender distribution, or weight between the two groups. (Table I) The development of sensory and motor blockages in group B was significantly earlier than in group A ($p<0.001$). The onset of sensory block took 10.6 ± 1.48minutes in group B versus 20.22.41 minutes in group A. In group B, the onset time of the motor block was 305.42 ± 23.8 minutes, compared to 250.57 ± 23.4 minutes in group A. (Table II). In the bupivacaine midazolam group, the mean duration of full analgesia was considerably longer ($p<0.001$). (Table II) At all points of observation, the mean (±SD) VAS score in Group B is lower than the mean VAS score in Group A. At 270 minutes, 330 minutes, and 390 minutes, the mean (±SD) VAS score in Group B is considerably ($p<0.05$) lower than the mean VAS score in Group A. At 30 minutes, 28.57 percent of patients in group B had a sedation level of 1; after that, 22.86 percent of patients had a sedation score of 1.

Table 1: Demographic Characteristics

Sex	Group A	Group B	Total
	n (%)	n (%)	n (%)
Male	28 (80)	25 (71.43)	53 (75.71)
Female	7 (20)	10 (28.57)	17 (24.29)
	Group A	**Group B**	**P-value**
Age(in Yrs)	37.97± 13.73	39.28± 14.19	p > 0.05
Weight (in kg)	52.94± 6.99 kg	55.05± 7.0 kg	p > 0.05

Table 2: Characteristics of sensory and motor blocks in two groups.

Time	Group A (Mean±SD)	Group B (Mean±SD)	p-value
Sensory block			
Onset(minutes)	20.2 ±2.41	10.6 ±1.48	<0.0001
Duration(minutes)	250.57 ±23.4	305.42 ±23.8	<0.001
Motor block			
Onset(minutes)	22.08 ± 2.58	12 ± 1.55	<0.0001
Duration(minutes)	221.71±24.06	275.71±19.6	<0.001

Table 3: Postoperative pain score in two groups.

Time (from induction in minutes)	Group – A Mean± SD	Group – B Mean± SD	P-Value
90 Minutes.	0.00± 0.000	0.00 ± 0.000	----------
150 Minutes.	0.00 ± 0.000	0.00 ± 0.000	----------
210 Minutes.	0.071 ± 0.423	0.00 ± 0.00	0.32
270 Minutes	3.76 ± 1.84	0.743 ± 1.40	<.0001
330 Minutes	6.21 ± 0.98	4.26 ± 1.21	<.0001
390 Minutes	8.07 ± 0.608	6.76 ± 0.965	<.0001

DISCUSSION

The current study was conducted in the Department of Anaesthesiology at G.R. Medical College and J.A. Group of Hospitals, Gwalior, with the goal of comparing the onset, duration, quality of analgesia, and complications associated with brachial plexus block. Depending on the medicine injected, the patients were randomly assigned to one of two groups (Group A or Group B). Through the axillary approach, Group A (n=35) received 30 ml of 0.5 percent Bupivacaine, and Group B (n=35) received 30 ml of 0.5 percent Bupivacaine + Midazolam 50g kg-1 in the brachial plexus sheath. Because of its long duration of action, bupivacaine is the most commonly used local anesthetic for brachial plexus block. Despite this, when done alone, brachial plexus block offers short-term postoperative analgesia. To extend the duration of analgesia, many additional medications have been explored in combination with local anesthetics.[21] Group A had a mean onset time of 20.2 ± 2.41 minutes, while group B had a mean onset time of 10.61.488 minutes. The duration of analgesia was determined to be 250.57 ± 23.38 minutes in Group A and 305.42 ± 23.80 minutes in Group B, respectively. When compared to group A, the duration of analgesia in group B was significantly longer. As a result, when Midazolam HCl was mixed with bupivacaine HCl and injected around the brachial plexus, the duration of analgesia was extended. Midazolam's antinociceptive effect may be related to its activity on GABA-A receptors in the brachial plexus, resulting in antinociception. In comparison to Group A (221.71 ± 24.06), the duration of the motor block was also longer in Group B (275.4119.6 min). Min-Soo Kim *et al.*[22] found a motor block lasting 169 minutes after taking Midazolam HCl, compared to 123 minutes in the control group. Analgesia was measured using a visual analog scale (VAS) in the immediate postoperative period and at hourly intervals. A score of greater than 6.5 on the VAS was considered full analgesia cessation. After 270 minutes, group A had a higher VAS score than group B. It was statistically significant (P<0.05) that they differed. Chernik [23] sedation score was used to assess sedation throughout both the intraoperative and postoperative periods. At 30 minutes, 28.6% of patients in Group B had a sedation level of 1 (sleeping but responding to verbal commands), while at 60 minutes, 22.86 percent of patients had a sedation score of 1. After utilizing Midazolam as an adjuvant, Koj Jarbo *et al.*[14] reported similar results. There were no adverse reactions or any issues in either group of participants.

CONCLUSION

Patients who receive a brachial plexus block that includes both midazolam HCl and inj. bupivacaine HCl had a faster

onset of sensory and motor block, a longer duration of sensory and motor block, and better postoperative analgesia than those who receive bupivacaine HCl alone. The study discovered that midazolam HCl provides conscious sedation with no side effects or complications.

REFERENCES

1. Hadzic A., Vloka J. D. et al. Peripheral Nerve Blocks: Principles and Practice, the New York School of Regional Anesthesia, New York, NY, USA, 2004.
2. Lund P, Cwik J, Vallesteros F. Bupivacaine-A New Long-Acting Local Anesthetic Agent. Anesthesia andamp; Analgesia. 1970;49(1):103-113..
3. Patacsil JA, McAuliffe MS, Feyh LS, et al. Local Anesthetic Adjuvants Providing the Longest Duration of Analgesia for Single- Injection Peripheral Nerve Blocks in Orthopedic Surgery: A Literature Review. Aana j. 2016;84:95-103.
4. Bailard NS, Ortiz J, Flores RA. Additives to local anesthetics for peripheral nerve blocks: Evidence, limitations, and recommendations. Am J Health Syst Pharm. 2014;71:373-85.
5. Opperer M, Gerner P, Memtsoudis SG. Additives to local anesthetics for peripheral nerve blocks or local anesthesia: a review of the literature. Pain Manag. 2015;5:117-28.
6. Popping DM, Elia N, Marret E, et al. Clonidine as an adjuvant to local anesthetics for peripheral nerve and plexus blocks: a meta-analysis of randomized trials. Anesthesiology. 2009;111:406-15.
7. Bazin JE, Massoni C, Bruelle P, et al. The addition of opioids to local anaesthetics in brachial plexus block: the comparative effects of morphine, buprenorphine and sufentanil. Anaesthesia. 1997;52:858-62.
8. Bazin JE, Massoni C, Groslier D, et al. Brachial plexus block: effect of the addition of sufentanil to local anesthetic mixture on postoperative analgesia duration. Ann Fr Anesth Reanim. 1997;16:9-13.
9. Culebras X, Van Gessel E, Hoffmeyer P, Gamulin Z. Clonidine combined with a long acting local anaesthetic does not prolong postoperative analgesia after brachial plexus block but does induce hemodynamic changes. Anesth Analg 2001; 92:199-204.
10. Bedder MD et. al.: Comparison of bupivacaine and alkalinized bupivacaine in brachial plexus anesthesia. Anesth Analg 1988; 67: 48–52.
11. Edwards M et. al.: On the mechanism by which midazolam causes spinally mediated analgesia. Anesthesiology 1990; 73: 273–7.
12. Kim MH, Lee YM. Intrathecal midazolam increases the analgesic effects of spinal blockade with bupivacaine in patients undergoing haemorrhoidectomy. Br J Anaesth 2001; 86: 77–9.
13. Beurdeley-Thomas A, Miccoli L, Oudard S, Dutrillaux B, Poupon MF. The peripheral benzodiazepine receptors: a review. J Neurooncol. 2000;46:45–56.
14. Jarbo K, Batra YK, Panda NB. Brachial plexus block with midazolam and bupivacaine improves analgesia. Can J Anaesth. 2005;52:822–826.
15. Brown DA, Marsh S. Axonal GABA-receptors in mammalian peripheral nerve trunks. Brain Res 1978; 156: 187–91.
16. Freyer et al., J. Org. Chem., 1978. vol. 43(23), pp. 4480-4444.
17. Wallser A, Benjamin LES, Flynn T: Quinazolines and 1, 4-Benzodiazepines.84 synthesis and reactions of imidazo (1, 5α) (1,4-Benzodiazepine. J.Org. Chem., vol. 43(5), pp. 936-944, 1978).
18. Lenon: Brachial plexus anaesthesia and axillary sheath elastance. Anesth Anal.1983;62: 215-7.
19. Lanz E. et al. The extent of block following various technique of brachial plexus block anaesth.Anal.1983;62:55-8
20. Mahajan BK. Methods in Biostatistics. 6th ed. New Delhi (India): Jaypee Brothers Medical Publishers (p) Ltd; 2003. pp. 35–186.
21. Edwards M, Serrao JM, Gent JP, Goodchild CS. On the mechanism by which midazolam causes spinally mediated analgesia. Anesthesiology 1990; 73:273-7.
22. Kim M. et al.: The Effect of the Addition of Fentanyl and Midazolam to Lidocaine in a Supraclavicular Brachial Plexus Block. (Korean J Anesthesiol 2008; 54: 167-72.
23. Karpal et al.: tramadol added to mepivacaine prolongs the duration of an axillary brachial plexus depth anaesth.Anal.1999; 88: 853-6.

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