

## A COMPARATIVE STUDY OF BUPIVACAINE WITH MIDAZOLAM AND BUPIVACAINE ALONE IN BRACHIAL PLEXUS BLOCKADE

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### ABSTRACT

#### BACKGROUND

Regional anaesthesia as the name implies is the blocking of peripheral nerve conduction in a reversible manner by using local anaesthetic agents, thereby one region of the body is made insensitive to pain and is devoid of reflex response to surgical stimuli. Regional anaesthesia offers many advantages over general anaesthesia<sup>1-5</sup> for surgery on upper extremities, particularly in emergency operations. This study was designed as a prospective, randomised comparative study. After receiving the institutional ethical committee approval and informed consent, the patients were randomly allocated into two groups. Supraclavicular brachial plexus was performed via subclavian perivascular technique.

#### MATERIALS AND METHODS

Forty adult patients of both sexes in the age group of 20-60 years belonging to ASA I/II category and their weight ranging between 50-70 kgs posted for various types of upper limb surgeries at the Department of Plastic Surgery, Institute of Research and Rehabilitation of Hand, Government Stanley Hospital, formed the study group.

#### RESULTS

Onset time for both motor and sensory block was quicker in the bupivacaine with midazolam group. There was no significant difference between the groups in the time taken for completion of both motor and sensory blockade.

#### CONCLUSION

Midazolam can be considered as a safe additive to local anaesthetic solution for brachial plexus block.

#### KEYWORDS

Midazolam, Additive, Bupivacaine, Brachial Plexus, Anaesthesia, Regional/Local.

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#### BACKGROUND

Regional anaesthesia as the name implies is the blocking of peripheral nerve conduction in a reversible manner by using local anaesthetic agents, thereby one region of the body is made insensitive to pain and is devoid of reflex response to surgical stimuli. The central nervous system is spared, so the patient is conscious during the surgical procedure. Regional anaesthesia offers many advantages over general anaesthesia<sup>1-5</sup> for surgery on upper extremities, particularly in emergency operations.

#### The Advantages of Regional over General Anaesthesia are-

- Causes least disturbance to the normal physiology than any other type of anaesthesia.
- Proven to be safe for high-risk patients who are in greater risk due to the stress imposed by general anaesthesia.
- Only method of anaesthesia, which prevents all afferent impulses from the site of surgery from reaching the CNS. Hence, the need for polypharmacy and its attendant risks are eliminated.
- Along with complete pain relief and total muscle relaxation it produces vasodilatation, which improves blood circulation and prevents tissue hypoxia.
- Many intraoperative and postoperative complications of general anaesthesia are avoided.
- Postoperative pain relief is ensured for a longer duration by using long-acting local anaesthetic drug and for several days if continuous block using catheter technique is employed.
- It is cost effective and safe.
- Avoids theatre pollution.

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- Safest technique for patients with full stomach.
- All the adverse effects of airway manipulation can be avoided.

The frequent use of pneumatic tourniquet to provide a bloodless field during surgery makes individual nerve blocks impractical. Brachial plexus block<sup>6</sup> is the answer in such a situation. There are different approaches, but the ones frequently employed for blocking the brachial plexus<sup>2</sup> include-

- a) Supraclavicular approach.
- b) Infraclavicular approach.
- c) Axillary approach.
- d) Interscalene approach.

This study is intended to determine the effects of adding midazolam to bupivacaine in brachial plexus blockade by supraclavicular approach with regard to the onset, intensity and duration of blockade along with its analgesic efficacy.

### Aims and Objectives

To study the effects of bupivacaine with midazolam and bupivacaine alone in brachial plexus blockade.

### MATERIALS AND METHODS

Forty adult patients of both sexes in the age group of 20-60 years belonging to ASA I/II category and their weight ranging between 50-70 kgs posted for various types of upper limb surgeries at the Department of Plastic Surgery, Institute of Research and Rehabilitation of Hand, Government Stanley Hospital, formed the study group. This study was designed as a prospective, randomised comparative study. After receiving the institutional ethical committee approval and informed consent, the patients were randomly allocated into two groups. Supraclavicular brachial plexus was performed via subclavian perivascular technique.

Hollmen's scale was assessed. Onset of blockade, both sensory and motor is defined as a minimum of grade 2 in Hollmen's scale.

Blockade was considered complete when sensory and motor scores were at least grade 3 in Hollmen's scale. Only patients with complete motor block were included in the study.

Once block was complete, the patient was wheeled into the theatre and surgery was allowed to proceed. The anaesthetist was in charge of the whole procedure.

### Groups

1. BM - 20 patients received 30 mL of 0.5% bupivacaine with preservative free midazolam 50 µg/kg.
2. B - 20 patients received 30 mL of 0.5% bupivacaine alone.

### Inclusion Criteria

- ASA I and II.
- Age group 20-60 years.
- Weight 50-70 kilograms.
- Surgeries of forearm and hand.

### Exclusion Criteria

- Patient refusal.
- Coagulopathy.
- Infection at injection site.
- Pneumothorax or previous pneumonectomy on the opposite side.

Patients were all preoperatively evaluated, clinically examined and investigations done prior to assessment. Procedures were explained in detail and written consent obtained.

The procedure was carried out in the preparation room or in the theatre where facilities for resuscitation were available.

### Statistics

Sample size of 20 per group was adequate for the present study. This number was given by a certified statistician.

All the statistics were done using the latest SPSS Software, California (2015).

Demographic variables in qualitative form were analysed using the Pearson Chi-squared test and quantitative form data (weight, age) were analysed using the Student's independent t-test.

Clinical data like onset, completion, duration and intensity of blockade were analysed using the Student's independent t-test.

Statistical significance with regard to sedation was analysed with Pearson.

Chi-squared test, P value <0.05 was taken as statistically significant.

### RESULTS

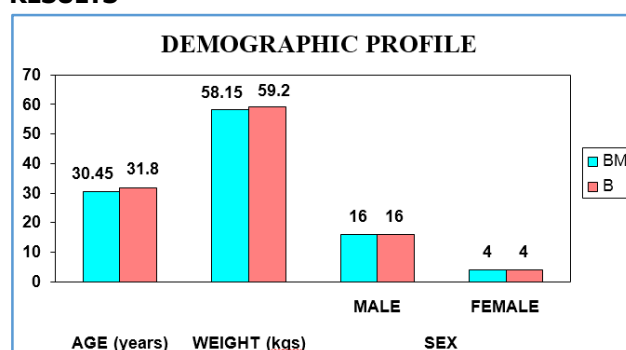


Image 1. Demographic Profile

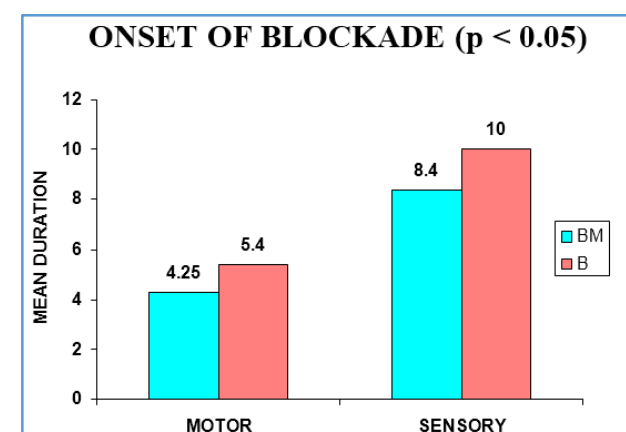
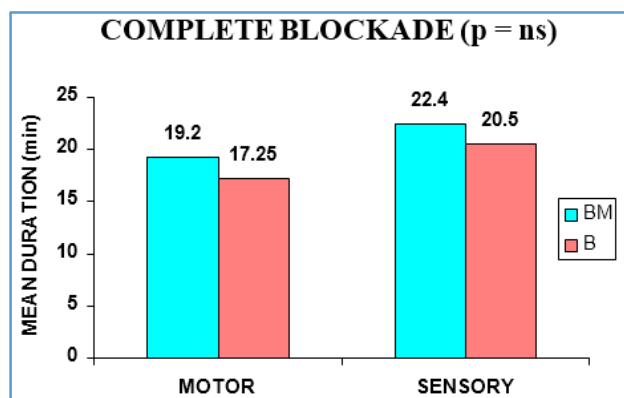
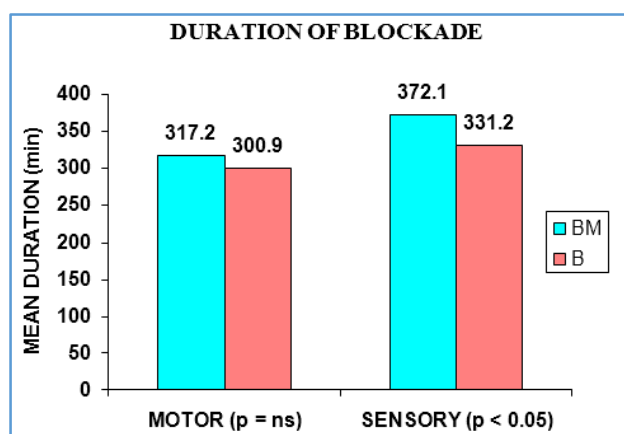
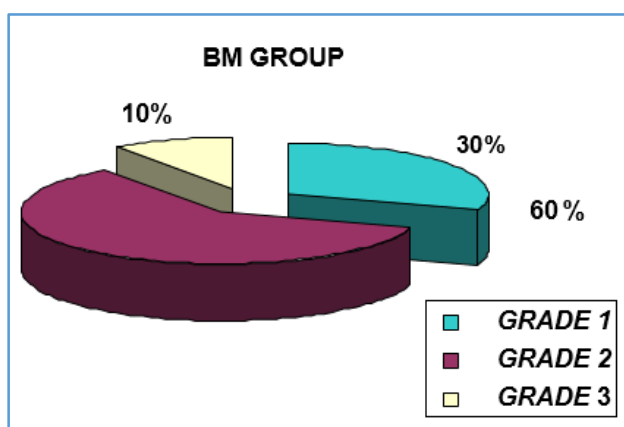
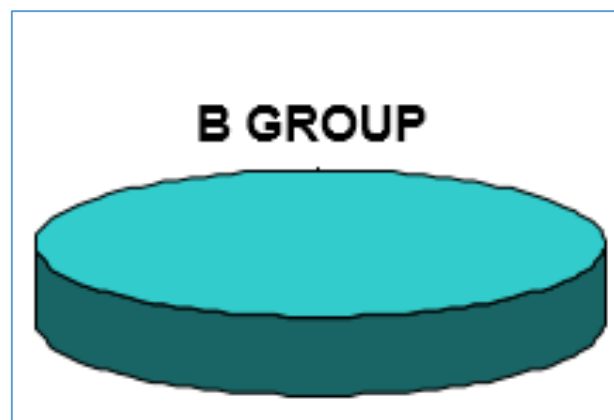
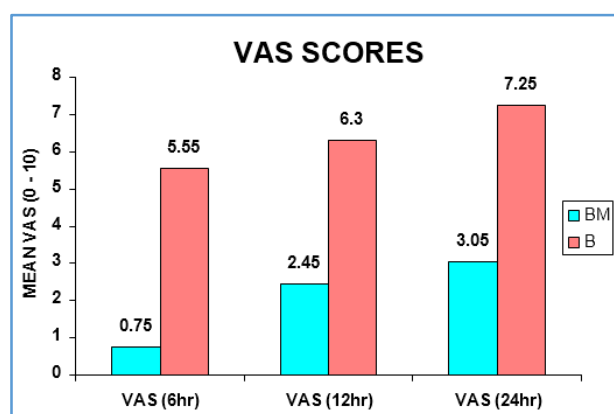


Image 2. Onset of Blockade

**Image 3. Complete Blockade****Image 4. Duration of Blockade**

	Grading	Group BM	Group B
Motor	4	14 (70%)	17 (85%)
	3	5 (25%)	3 (15%)
	2	1 (5%)	0
	1	0	0
Sensory	4	15 (75%)	13 (65%)
	3	5 (25%)	7 (35%)
	2	0	0
	1	0	0

**Table 1. Intensity of Blockade****Image 5****Image 6. Sedation****Image 7. VAS Scores**

### Complications

There was one incidence of arterial puncture without formation of haematoma. Needle was again repositioned and drug administered. Block was successful.

### DISCUSSION

Brachial plexus blockade offers an excellent alternative technique to general anaesthesia in anaesthetising the upper limb for surgical procedures. Various approaches for successful performance of these blocks and for reducing the complications have been described.

The technique chosen in this study was the subclavian perivascular technique. In 1964, this technique was described by Winnie<sup>7</sup> and it allowed accurate percutaneous localisation of the plexus. He used the concept that there is a constant relationship between the anterior and middle scalene muscles, the plexus and the first rib and that there is an advantage of the continuity of the neurovascular sheath of the brachial plexus. Winnie's concept that the roots of the plexus were sandwiched between the two scalene muscles and the muscles are always found to be inserted in the first rib. Hence, he introduced the needle between the two muscles and in the direction of the space between them. Thus, by using a single needle technique eliciting paraesthesia or vascular pulsation as a guide to confirm the needle placement in the space, he injected the anaesthetic solution, which will be confined to the perineural and perivascular area. Hence, he was almost

certain of a complete and safe block. This technique by Winnie was anatomically precise and conceptually logical.

The role of paraesthesia<sup>8</sup> is controversial. Various studies have concluded that paraesthesia during needle insertion improves the success rate of the blocks. Elicitation of paraesthesia may also pose problems in the form of direct neural damage by the advancing needle. While demonstration of paraesthesia may aid in positioning the needle for blockage, it is not absolutely essential for the success of the block. The aid of a nerve locator is definitely logical, but considering the economy and large number of cases being performed under expert guidance, our technique seems to be practical.

The longer acting local anaesthetics (bupivacaine, ropivacaine) have been associated with longer latencies and higher failure rates.<sup>2</sup> Latency can be decreased through the appropriate choice of injection site, higher concentration of drug used and appropriate volume. The efficacy and safety of 0.5% bupivacaine is already proved. Hence, 30 mL bupivacaine 0.5% used.

Various agents like epinephrine, opioids, clonidine, neostigmine, hyaluronidase and bicarbonate have been used as adjuvants<sup>9</sup> to local anaesthetics in brachial plexus block to quicken the onset, increase the duration and enhance the quality of block and also reduce the postoperative analgesic requirements. The results have been mixed and at times associated with side effects.

Midazolam as an additive to local anaesthetics have been studied in the intrathecal, epidural and caudal routes.<sup>10</sup> It has been proved in these studies that midazolam is as useful additive by way of improved analgesia and with sedation. 50 µg/kg midazolam in central neuraxial blocks did not produce any significant adverse effects. Studies in animals have showed no neurotoxic effects of intrathecally administered midazolam.<sup>11</sup> Potentiation of analgesic effects of intrathecal fentanyl with midazolam in labouring patients has been demonstrated.<sup>12</sup> Intrathecal midazolam 2 mg did not increase the occurrence of neurologic or urologic symptoms. Hence, this dose (50 µg/kg) was chosen in this study.

In this prospective randomised comparative study, 40 patients satisfying the selection criteria underwent brachial plexus block with or without addition of preservative free midazolam. Comparison of onset, completion, duration and intensity of blockade, sedation and quality of analgesia between the two groups were observed and statistically analysed.

The onset of sensory and motor blockade was quicker in the BM group. This could be due to the synergistic action of midazolam with that of local anaesthetics.<sup>13</sup>

The onset of motor block was found to be faster than the sensory block onset. This may be attributed to the arrangement of nerve fibers in the trunks as described by Winnie.<sup>14</sup> Motor fibers are located more peripherally than sensory fibers, hence a local anaesthetic drug will begin to block motor fibers before it arrives at the centrally located sensory fibers.

Duration of sensory block tended to last longer than motor block in the present study. This is in line with the observations made by de Jong et al<sup>15</sup> who explained that large fibers require a higher concentration of local anaesthetic than small fibers. The minimal effective concentration of local anaesthetic for large (motor) fibers is greater than for small (sensory) fibers. Thus, motor function return before pain perception and duration of motor block is shorter than the sensory block.

In this study, pain scores were significantly lower in patients who received midazolam in addition to bupivacaine. The number of patients who required rescue analgesia was also lower in this group. The prolonged analgesia in Group BM could be due to the action of midazolam on GABA-A receptors present in the brachial plexus and thus producing antinociception. Various authors have demonstrated the presence of GABA receptors in peripheral nerves. Brown and Marsh<sup>16</sup> demonstrated GABA receptors in mammalian peripheral nerve trunk.

Bhisitkul et al<sup>17</sup> showed that axonal GABA receptors are present on both normal and regenerated sensory fibers in rat peripheral nerve. Cairns et al observed the presence of GABA receptors within the temporomandibular joint and that its activation could decrease the transmission of nociceptive signals. The action of midazolam on GABA receptors is well established.

Sedation scores were higher in patients in BM group compared to B group during the intraoperative period. This may be due to partial vascular uptake of the drug and its transport to the central nervous system where it acts and produces sedation. The limited duration of sedation could be explained by the fact that midazolam is highly lipophilic and diffuses faster into the blood vessels by its rapid clearance (6-11 mL/kg/min.) and short half-life (1.7-2.6 hr.).

The highest sedation score achieved was 3, i.e. the patient was asleep and arousable by mild physical stimulus. No patient experienced airway compromise or required airway assistance due to this sedation. No complications with regard to the technique or drug was observed.

## CONCLUSION

In conclusion, midazolam 50 µg/kg when used as an additive to 0.5% bupivacaine solution for supraclavicular brachial plexus block, quickens the onset of sensory and motor blockade, prolongs the duration of sensory blockade and improves the quality of postoperative analgesia with mild intraoperative sedation. Hence, midazolam can be considered as a safe additive to local anaesthetic solution for brachial plexus block.

## REFERENCES

- [1] Neal JM, Hebl JR, Gerancher JC, et al. Brachial plexus anesthesia: essentials of our current understanding. *Reg Anesth Pain Med* 2002;27(4):402-428.
- [2] Gerancher JC. Upper extremity nerve blocks. *Anesthesiol Clin North America* 2000;18(2):297-317.

- [3] Chilvers CR, Kinahan A, Vaghadia H, et al. Pharmacoeconomics of intravenous regional anaesthesia vs general anaesthesia for outpatient hand surgery. *Can J Anaes* 1997;44(11):1152-1156.
- [4] D'Alessio JG, Rosenblum M, Shea KP, et al. A retrospective comparison of interscalene block and general anesthesia for ambulatory surgery shoulder arthroscopy. *Reg Anaesth* 1995;20(1):62-68.
- [5] Thompson AM, Newman RJ, Semple JC. Brachial plexus anaesthesia for upper limb surgery: a review of eight years' experience. *J Hand Surg Br* 1988;13(2):195-198.
- [6] Urban MK, Urquhart B. Evaluation of brachial plexus anesthesia for upper extremity surgery. *Reg Anesth* 1994;19(3):175-182.
- [7] Winnie AP, Collins VJ. The subclavian perivascular technique of brachial plexus anaesthesia. *Anesthesiology* 1964;25:353-363.
- [8] Franco CD, Vieira ZE. 1,001 subclavian perivascular brachial plexus blocks: success with a nerve stimulator. *Reg Anesth Pain Med* 2000;25(1):41-46.
- [9] Viel EJ, Eledjam JJ, Die La Coussaye JE, et al. Brachial plexus block with opioids for postoperative pain relief: comparison between buprenorphine and morphine. *Reg Anaesth* 1989;14(6):274-278.
- [10] Yegin A, Sanli S, Dosemeci L, et al. The analgesic and sedative effects of intrathecal midazolam in perianal surgery. *Eur J anaesthesiol* 2004;21(8):658-662.
- [11] Serrao JM, MacKenzie JM, Goodchild CS, et al. Intrathecal midazolam in the rat: an investigation of possible neurotoxic effects. *Eur J Pharmacol* 1990;7:115-122.
- [12] Tucker AP, Mezzatesta J, Nadeson R, et al. Intrathecal midazolam II: combination with intrathecal fentanyl for labor pain. *Anesth Analg* 2004;98(6):1521-1527.
- [13] Edwards M, Serrao JM, Gent JP, et al. On the mechanism by which midazolam causes spinally mediated analgesia. *Anesthesiology* 1990;73(2):273-277.
- [14] Winnie AP, Tay CH, Patel KP, et al. Pharmacokinetics of local anesthetics during plexus blocks. *Anesth Analg* 1977;56:852-861.
- [15] De jong RH, Wagman IH. Physiological mechanisms of peripheral nerve block by local anesthetics. *Anesthesiology* 1963;24:684-727.
- [16] Brown DA, Marsh S. Axonal GABA-receptors in mammalian peripheral nerve trunks. *Brain Res* 1978;156(1):187-191.
- [17] Bhisitkul RB, Villa JE, Kocsis JD. Axonal GABA receptors are selectively present on normal and regenerated sensory fibers in rat peripheral nerves. *Exp Brain Res* 1987;66(3):659-663.