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Original research article

Efficacy of supraclavicular brachial plexus block with midazolam, bupivacaine and lignocaine in upper limb surgeries: A randomized comparative clinical study

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Abstract

An effective Brachial plexus block provides a useful alternative to General anaesthesia for upper limb surgery producing complete muscle relaxation. It provides surgical anaesthesia in upper extremity surgery, postoperative analgesia and chronic pain management. Brachial plexus block also maintains stable intraoperative hemodynamics and associated sympathetic block. The sympathetic block decreases postoperative pain, vasospasm and edema. Patients were randomized into two equal groups of 30 each. Group B-receive Inj Bupivacaine (0.5%) 20ml + Inj Lignocaine (2%) 10ml with Inj Adrenaline (1:2,00,000). Group BM- receive Inj Bupivacaine (0.5%) 20ml + Inj Lignocaine (2%) 10ml with Inj Adrenaline (1:2,00,000) + Inj Midazolam 50 microgm/kg. Onset and duration of sensory and motor blockade, post operative pain and hemodynamic variables were compared. The onset and duration of sensory block in Group B and Group BM were significantly different. The onset of both sensory and motor block was significantly less, and duration was significantly higher in the BM group compared to Group B (p<0.05). In the post-operative period, more patients in group B demanded rescue analgesia as compared to group BM. (p<0.001).

Key words: Supraclavicular Brachial Plexus Block, Midazolam, Bupivacaine

Introduction

The supraclavicular method of brachial plexus block is generally used for surgeries of the upper limb and is highly successful. The supraclavicular block was at first performed by Kulenkampff in Germany in 1911 on himself. After a few months, Hirschel propagated a method for brachial plexus block with an axillary approach. Kulenkampff and Persky published a long paper of their experiences in 1928, without any major complications. The supraclavicular method of plexus block is teachable and learnable. It eliminates pain from the arm, forearm and hand, and produces a motor
and sensory paralysis directly proportionate to the degree of skill with which the anaesthesia has been produced1. As per the Kulenkamp‘s technique, the patient was required to be in the sitting position. The needle was to be carefully inserted above the midpoint of the clavicle in the same direction as of the spinous process of T2 or T3. Pnuemothorax was the risk that corresponded with the medial orientation of the needle and hence, resulted in disapproval by many centers. In order to reduce the risk of Pnuemothorax recommendations for modifying the basic technique were proposed by many studies.

The supraclavicular brachial plexus block has time and again proven to be an important, safer and an effective alternative to General Anesthesia. It includes blocking of brachial plexus where it is most compactly arranged, with less requirement of the anaesthetic solution and rapid onset of action2. Brachial plexus block can be approached by any of the four techniques – interscalene approach, supraclavicular approach, infraclavicular approach and axillary approach3. However, the supraclavicular technique has advantages over the rest of the brachial plexus block approaches. The main advantages are its rapid onset and complete and predictable anesthesia for entire upper extremity, particularly for hand surgery. Since the last decade, ultrasound has been introduced as a tool for guidance to give regional anesthesia. It has, in turn, resulted in a significant increase of interest in the clinical application of the supraclavicular block, along with a greater understanding of its mechanics [4].

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Methodology

After taking written consent from the patients, 60 patients ASA physical status I or II belonging to either sex aged between 20-65 yrs undergoing upper limb surgeries in Orthopedics and General Surgery were included. Patients who were admitted for open reduction of fracture humerus with K wire fixation, plating or screw, fracture of radius/ulna and fracture of olecranon etc. under supraclavicular brachial plexus block were taken under the research criteria. The patients underwent detailed preanaesthetic evaluation prior to administering the anesthesia. Various routine and patient-specific evaluations were done depending on the clinical health of the patient. The patients were given proper training regarding VAS (Visual Analogue Score) scale used for determining the level of pain on the score of 0-10, wherein 0 stands for no pain and 10 denoted worst imaginable pain. Other hemodynamic variables namely, BP, HR, SPO2 had been analysed in order to obtain desired results.

As per randomization done by closed envelope method the patients were divided into two groups with 30 patients each. The division of the groups was on the basis of the drugs given to them:

Group B: Received Inj Bupivacaine (0.5%) 20ml + Inj Lignocaine (2%) 10ml with Inj Adrenaline (1:2,00,000).

Group BM: Received Inj Bupivacaine (0.5%) 20ml + Inj Lignocaine (2%) 10ml with Inj Adrenaline (1:2,00,000) + Inj Midazolam 50 microgm/kg.

The patients were kept nil per oral (NPO) for six hours. Pulse oxymeter, non- invasive blood pressure cuff and ECG electrodes were applied, and baseline heart rate, blood pressure, oxygen saturation and pain score were recorded. All patients were given Inj Ondansetron 4mg IV and Inj Ranitidine 50mg IV.

Inclusion criteria

1. ASA I and II patients of either sex.
2. Aged between 20 to 60 years
3. Undergoing elective upper limb surgeries.

Exclusion criteria

1. Patients with known hypersensitivity to local anaesthetic drugs.
2. Patients with bleeding disorders, uncontrolled diabetes mellitus, renal and liver diseases.
3. Pregnant women, patients with epilepsy.
4. Mentally unstable patients and Patient Refusal

Results

Table 1: Onset of Sensory Block Time

	Group B	Group BM	p-value
Onset of Sensory Block (Mins)	9.01±1.13	5.43±0.59	0.000

- In the present study, onset of sensory block is defined as time elapsed between injection of drug and complete loss of sensation in hand.
- The mean time of onset of sensory block in Group B was 9.01±1.13 minutes and the mean time of onset of sensory block in Group BM was 5.43±0.59 minutes.
- As per t-test, p=0.000, this shows there is statistically significant difference in the onset of sensory block between the two groups. The onset of sensory block for Group BM was significantly less than that of Group B.

Table 2: Onset of Motor Block Time

	Group B	Group BM	p-value
Onset of Motor Block (Mins)	9.47±0.99	6.81±0.99	0.000

- In the present study, onset of motor block is defined as the time interval between injection of drug and complete motor block.
- The mean duration of onset of motor block for Group B was 9.47±0.99 minutes and the mean onset of motor block for Group BM was 6.81±0.99 minutes.
- As per t-test, p=0.000 showing that there was statistically significant difference in the mean duration of onset of motor block between the two groups. The mean duration of onset of motor block for Group B was significantly higher than that of Group BM.

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Table 3: Duration of Sensory Block

	Group B	Group BM	p-value
Duration of Sensory Block (Mins)	338.33±42.10	538.0±42.62	0.000

- In present study, duration of sensory block is defined as time elapsed between injecting the drug and appearance of pain requiring analgesia.
- The mean duration of sensory block for Group B was 338.33±42.10 minutes and that of Group BM was 538.0±42.62 minutes.
- As per t-test, p=0.000 showing that there is statistically significant difference in the duration of sensory block between the groups. The duration of sensory block for Group BM was significantly higher than that of Group B.

Table 4: Duration of Motor Block

	Group B	Group BM	p-value
Duration of Motor Block (Mins)	387.17±48.63	618.0±42.86	0.000

- For the present study, duration of motor block is defined as time elapsed between injection and complete return of muscle power. The mean duration of motor block for Group B was 387.17±48.63 minutes and that of Group BM was 618.0±42.86 minutes.
- As per the t-test, p=0.000 showing that there is statistically significant difference in the duration of motor block between the two groups. The duration of motor block for Group BM is significantly higher as compared to Group B.

Table 5: VAS Scores

VAS Score	Group B	Group BM	p-value
0 Min	0.0±0.0	0.0±0.0	0.000
15 Mins	0.0±0.0	0.0±0.0	-
30 Mins	0.0±0.0	0.0±0.0	-
45 Mins	0.0±0.0	0.0±0.0	-
1 Hr	0.0±0.0	0.0±0.0	-
2 Hrs	0.0±0.0	0.0±0.0	-
3 Hrs	0.0±0.0	0.0±0.0	-
4 Hrs	0.07±0.365	0.0±0.0	0.321
5 Hrs	0.20±0.610	0.0±0.0	0.078
6 Hrs	0.90±1.373	0.07±0.365	0.002
7 Hrs	0.80±1.215	0.0±0.0	0.001
8 hrs	2.73±1.837	0.53±1.168	0.000
12 Hrs	3.40±1.632	2.23±1.478	0.005
24 Hrs	5.60±0.968	3.63±0.765	0.000

Visual Analogue Sore used for pain assessment was comparable and statistically significant after 5 hours time as $p<0.05$ for each interval after 5 hours. This shows that there was statistically significant difference in the VAS score between the two groups. VAS for Group B was significantly higher as compared to Group BM. The score was 0 in Group B till 3 hours and in Group BM till 5 hours. The score was highest at 24 hours in both the Groups.

Table 6: Culebras Sedation Score

	Culebras Sedation Score at 30 mins		Culebras Sedation Score at 1 hour		Culebras Sedation Score at 6 hours		Culebras Sedation Score at 24 hours	
Group	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
B	30	0	30	0	30	0	30	0
(%)	100	0	100	0	100	0	100	0
BM	14	16	19	11	30	0	30	0
(%)	46.66	53.33	63.33	36.66	100	0	100	0

As per Culebras Sedation Score, all the patients in group B had a score of 1 for Culebras Sedation. On the other hand, in group BM, at 30 minutes 46.66% (n = 14) patients had a score of 1 while 53.33% (n = 16) patients had a score of 2. Further, at 1 hour, 63.33% (n = 19) patients had a score of 1 while 36.66% (n = 11) patients had a score of 2. After that, all the patients in group BM had score of 1.

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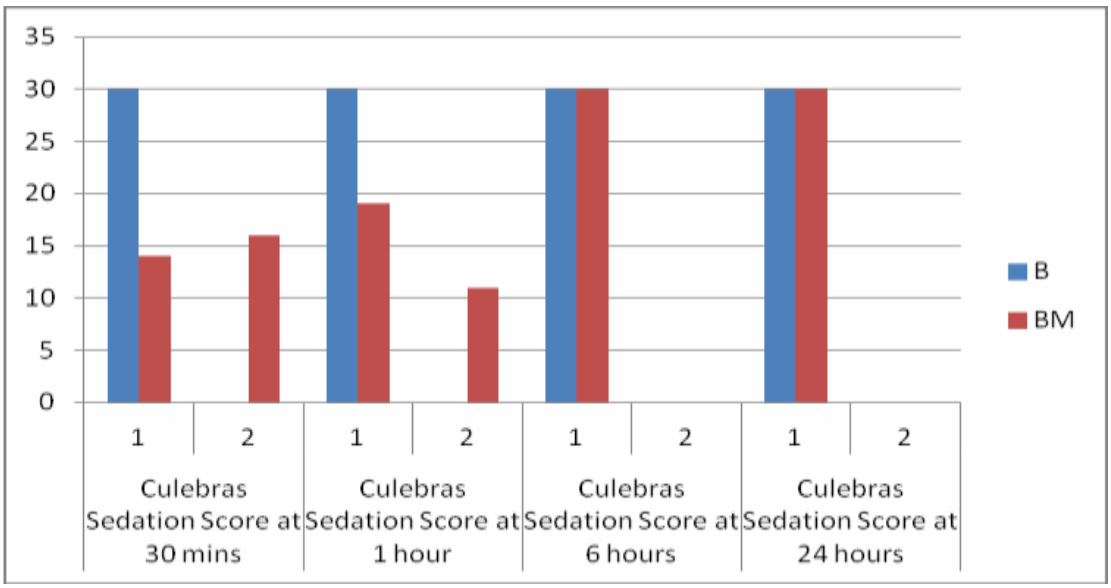

Fig 1: Culebras Sedation score

Discussion

The present study is about comparing the efficacy of Bupivacaine and Lignocaine with and without Midazolam with regards to onset and duration of motor and sensory block in patients undergoing upper limb surgeries. Further, the study also compares the postoperative pain score, use of rescue analgesics and adverse effects in patients receiving Bupivacaine and Lignocaine with and without Midazolam. The present study was conducted on 60 patients, out of which 30 patients were assigned to Group B who received Inj Bupivacaine (0.5%) 20ml + Inj Lignocaine (2%) 10ml with Inj Adrenaline (1:2,00,000) and remaining 30 patients were assigned to Group BM who received Inj Bupivacaine (0.5%) 20ml + Inj Lignocaine (2%) with Inj Adrenaline (1:2,00,000) 10ml + Inj Midazolam 50 microgm/kg.

On comparing duration of surgery, it was found that there is no statistically significant difference in the duration of surgery (p>0.05) between the groups. The onset of sensory block for Group BM (5.43±0.9 mins) was significantly less than that of Group B (9.01±1.13 mins). Similarly, the onset of motor block in Group BM (6.81±0.99) was significantly lesser than that of Group B(9.47±0.99) (p<0.05). The mean duration of onset of sensory and motor block for Group BM was significantly less than that of Group B. The mean duration of sensory block in Group BM (538.0±42.62 minutes) was significantly longer than the mean duration of sensory block in Group B (338.33±42.10 minutes). There is statistically significant difference in the duration of sensory block (p<0.05) between the groups.

Similarly the mean duration of motor block in Group BM (618.0±42.86 minutes) was significantly longer than mean duration of motor block in Group B (387.17±48.63 minutes).There is a statistically significant difference in the duration of motor block (p<0.05) between the groups.

On comparing VAS between the two groups it was found that there was statistically significant difference in the VAS score (p<0.05) between the two groups. VAS for Group B was significantly higher as compared to Group BM at various intervals in the postoperative period.

Further in our study, the duration of analgesia was assessed using the Visual Analogue Scale (VAS). Lower pain scores were observed in Group BM compared to Group B at intervals of 5hrs,6hrs,7hrs,8hrs,12hrs,24hrs which were statistically significant (p<0.05). This indicates the prolonged postoperative analgesia achieved by the addition of midazolam to local anaethetic agents. Finally, In Group B 16.66% of the patients required only one rescue analgesia and 83.33% of the patients required two rescue analgesia in postoperative period of 24 hours. On the other hand, in Group BM 26.66% of the patients did not require even rescue analgesia, 56.66% of the patients required one rescue analgesia and 16.66% patients required two rescue analgesia. Pain scores were significantly lower, and the demand for rescue analgesic was significantly less in Group BM. In addition, only 3.3% of the patients in Group BM reported cardio- vascular complication.

As per Culebras Sedation Score, all the patients in group B had a score of 1 for Culebras Sedation. On the other hand, in group BM, at 30 minutes 46.66% (n = 14) patients had a score of 1 while 53.33% (n = 16) patients had a score of 2. Further, at 1 hour, 63.33% (n = 19) patients had a score of 1 while 36.66% (n = 11) patients had a score of 2. After that, all the patients in group BM had score of 1. Even though 53.3% patients at 30 mins and 36.66% patients at 1 hour in Group BM showed a score of 2, they were mildly sedated, easily arousable with no drop in oxygen saturation or respiratory depression. This mild sedation

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was desirable and could be due to systemic absorption of midazolam. Further, limited duration of sedation is explained by short half life (1.7-2.6 hrs) and rapid clearance (6-11ml/kg/min)9.

Conclusion

Thus, overall it can be concluded that the onset and duration of sensory and motor block was significantly faster and longer respectively in the group of subjects receiving midazolam as an adjuvant. Pain scores were significantly lower, and the demand for rescue analgesic was significantly less. Thus, it can be said that efficacy of Bupivacaine and Lignocaine with Midazolam is high as compared to the efficacy of Bupivacaine and Lignocaine without Midazolam with regards to onset and duration of motor and a sensory block, postoperative analgesia and provides desirable anaesthesia without any significant side effects in patients undergoing upper limb surgeries.

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