Original Research Article

Assessment of Efficacy of Midazolam Added with Lignocaine and Bupivacaine to Brachial Plexus Block : A Comparative Study

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Abstract

Background: Regional anesthesia has much to offer for patients, surgeons and anesthesiologists because of its inherent simplicity, preservation of consciousness, avoidance of airway instrumentation, rapid recovery and significant postoperative analgesia. The supraclavicular block is one of several techniques used to accomplish anesthesia of the brachial plexus.**Objectives:**To evaluate analgesic efficacy, sedation, hemodynamic effects and complications, using midazolam (50ug/kg) added to brachial plexus block with lignocaine(1.2%) and bupivacaine (0.5%).**Methods:** It was comparative interventional study conducted at tertiary care hospital.The patients were for elective and emergency operations that came as cases of hand and forearm injuries during the period Oct-2007 to Oct-2008.**Results:** The latency for sensory block was minimum with group I (12.65±3.25mins) and maximum with group III (18.45±3.51mins). Similar results were shown for the motor block latency. When evaluated for the sedation score, it was found that there was statistically significant difference between the sedation in group II & III (p-value = 0.02) and I & III (p-value = 0.04) but there was no statistically significant difference between I & II (p-value = 0.59). Again, it was found that group I had minimum post-operative pain score of 40±14.87 and was maximum with group III 66.5± 10.77.**Conclusion:**The group with midazolam intervention were found to have minimum time for onset and maximum duration for sensory and motor block. Also, intervention group were having maximum sedation score and minimum post-operative pain score. We observed that there were no statistically significant variation in mean pulse, blood pressure throughout the observation period.

Keywords: Midazolam, brachial plexus block, lignocaine, bupivacaine

Introduction

Regional anesthesia has much to offer for patients, surgeons and anesthesiologists because of its inherent simplicity, preservation of consciousness, avoidance of airway instrumentation, rapid recovery and significant postoperative analgesia. The techniques are generally associated with minor sequelae and are very economical. Brachial plexus block has been widely used for forearm and hand surgery. Interscalene, axillary and supraclavicular are the various routes described for brachial plexus approaches.The supraclavicular block is one of several techniques used to accomplish anesthesia of the brachial plexus. The block is performed at the level of the brachial plexus trunks where the almost entire sensory, motor and sympathetic innervation of the upper extremity is carried in just three nerve structures confined to a very small surface area. Consequently, typical features of this block include rapid onset, predictable and dense anesthesia[1-5].Kulenkampff in Germany in 1911 performed the first percutaneous supraclavicular approach, reportedly on himself, a few months after Hirschel described a surgical approach to the brachial plexus in the axilla. The technique was later published in 1928 by Kulenkampff and Persky[4].The supraclavicular approach to local anesthetic blockade of the brachial plexus offers several advantages over other approaches. It has a high success rate and rapid onset of action, compared with the axillary approach[2,3]. It provides more complete anesthesia of the plexus, particularly the axillary and musculocutaneous nerves, and does not require abduction of arm to perform block.The interscalene approach is complicated by a higher incidence of injection into epidural or subarachnoid spaces or into the vertebral artery. Interscalene block may functionally spare the C-8 and T-1 nerve roots (primarily the ulnar nerve, which may be spared in 50% of blocks), making it a poor choice for hand and arm surgery. It is also difficult to master[2,6].The main disadvantage of regional anesthesia is the limited duration of analgesia it provides. In prolonged surgeries such as plastic surgeries, vascular surgeries, orthopedic surgeries, limited duration of analgesia may prove to be a drawback. This problem can be overcome by using long acting local anesthetics or using alternative techniques such as continuous regional anesthesia techniques, using catheters or malleable needles. Using this technique has its own technological problems and complications like infection and breakage of catheter etc. so better alternative is to use long acting local anesthetics. The problem of latency of analgesia can be overcome by using mixture of local anesthetics and addition of adjuncts in it[7,8].Of various local anesthetics used for brachial plexus block, bupivacaine is used most frequently, as it has a long duration of action varying from three to eight hours[8-10].Adjunct added to brachial plexus block should prolong the analgesic effect with-out incurring systemic side effects or prolonged motor block, and should also reduce the total dose of local anesthetic.

Various studies have investigated several adjuncts,including opioids,clonidine, neostigmine, hyaluronidase, and bicarbonate[11-

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15].The results have been in conclusive, because of associated side effects or doubtful efficacy.

Midazolam,a water-soluble benzodiazepine, is known to produce anti-nociceptionand to enhance the effect of local anesthetic when given epidurallyor intrathecally[16-18]. Midazolam produces this effect by its actionon gamma amino butyric acid-A (GABA-A) receptors.GABA-A receptors have also been found in peripheral nerves[19-21].We therefore sought to determine onset time and analgesic efficacy of midazolam + bupivacaine(0.5%) + lignocaine(1.2%) combination compared to bupivacaine (0.5%) + lignocaine(1.2%) combination for brachial plexus block.

Aims and Objectives: To evaluate analgesic efficacy, sedation, hemodynamic effects and complications, using midazolam (50 ug/kg) added to brachial plexus block with lignocaine(1.2%) and bupivacaine (0.5%).

Materials and Methods

Brachial plexus block through supraclavicular route, was studied in 60 patients during the year oct-2007 to oct-2008. The patients were for elective and emergency operations that came as cases of hand and forearm injuries. Adult patients were only selected with average weight varying from 50 to 70 kg.A detailed history of each patient was inquired into, regarding past illness and anesthetic experience, if any along with present illness. Special enquiry regarding brachial plexus and respiratory tract problem was also made.

A thorough general examination and systemic examination were carried out to exclude any cardiovascular, respiratory or neurological disease. The site of injection was examined carefully to rule out any skin infection.

All routine investigations, like hemogram and urine examination were carried out before all operations. The patients were divided into 3 groups.

Patients in Group 1(n=20) received 40ml of mixture of (20ml of 1.2% lignocaine + midazolam 50ug/kg) and 20 ml of 0.5% bupivacaine.

Patients in Group II received 40 ml of mixture of 20ml of 1.2% lignocaine and (20 ml of 0.5% bupivacaine +midazolam 50ug/kg).

Patients in Group III received 40 ml mixture of 20ml of 1.2% lignocaine +20 ml of 0.5% bupivacaine.

Hemodynamic variables (i.e., heart rate, noninvasive blood pressure, respiratory rate),pain scores and rescue analgesic requirements were to be recorded for 24 hr postoperatively.

Inclusion and exclusion criteria's

Inclusion criteria – ASA Gr I & II pt> 20 yr old

Exclusion criteria -- ASA Gr III & IV, deranged coagulation profile,Infection at site of block, BMI>25, history of Adverse reaction to local anaesthetics, systemic Diseases such as uncontrolled diabetes mellitus,Hypertension, renal disorders in which local anesthetics considered to expose patient to increased risk, age <20 yrs

Study procedure

Technique of supraclavicular block: The technique described by Macintosh and Mushin was followed:

Patient Positioning:Patient was asked to lie supine with a pillow under the shoulders and the head turned away from the side of injection. The affected arm is kept by the side of the body, shoulders lowered by asking the patient to reach for his knees so that the subclavian artery becomes easily palpable.After taking all the precautions, the site of injection was cleaned with betadine and then with spirit and allowed to dry. The surrounding areas were covered with sterile drapes. The anatomical landmarks were palpated. Mid clavicular point was taken and just above that subclavian artery was palpated. A skin wheal was raised with 2 cc of 2% lignocaine one centimeter above the mid clavicular point just lateral to the subclavian artery avoiding the external jugular vein. The local anesthetic solution to be injected according the group assigned kept ready. The anesthesiologist stand by the patient facing the head end of the patient. The position of the subclavian artery was confirmed by palpating with thumb of one hand and the artery pushed medially. The patient was instructed not to move the arm, instead advised to say "yes" when he feels tingling sensation in the upper limb. Now a 22 G needle about 5 cm long attached to a 20 cc syringe containing the local anesthetic solution was introduced through the skin wheal at an angle of about 80 degrees in a backward, inward and downward direction towards the upper surface of the first rib over which the plexus lies.When the patient said "yes" needle stopped there, syringe aspirated and if there was no blood, the local anesthetic solution was injected slowly at that site. Usually the brachial plexus lies at a depth of 3-4 cm from the skin. If the tingling sensation was not elicited the needle was further introduced in the same direction mentioned earlier to meet the first rib. Once the rib was met, 'rib walking' was done in the antero-posterior direction to elicit tingling sensation. If the patient says "yes", aspiration was done and if no blood comes then the local anesthetic solution was injected there.

If tingling sensation was not elicited even after rib walking then the needle direction was changed slightly and the procedure was repeated. Even with this, if tingling sensation was not elicited then the drug was injected slowly as the needle was withdrawn towards the skin. This is called "PARTICK'S TECHNIQUE."

During the procedure, if sub-clavian artery punctured accidentally, the needle was withdrawn immediately and pressure was applied over the artery for 15 min. and then the procedure was repeated with a little change in the direction of the needle. Once the drug was injected, the pillow under the shoulder was removed and the head was now turned to the same side of injection and massaging was done over the site of injection. All these procedures help in spread of local anesthetic solution.

- Onset of sensory and motor blocks was tested with pinprick and finger movements respectively. Latency of the block was taken as the time taken for the complete loss sensation and finger movements.
- Sedation was assessed using the sedation score described by Culebras et al.[13] (1- awake and alert, 2- sedated, responding to verbal stimulus, 3- sedated, responding to mild physical stimulus, 4- sedated, responding to moderate or severe physical stimulus, 5- not arousable).
- Pain was assessed using a numerical rating pain score scale where zero (0) represents no pain, and 100 means the worst possible pain.
- Quality of sensory and motor blocks were also assessed and graded as good, partial and poor as follows:

Good: Complete loss of sensation with total motor paralysis

Partial: Incomplete sensory block with minimal finger movements present.

Poor: No sensory block with complete range of movements present.

Intraoperatively: Pulse, blood pressure, respiration, sedation score and pain score were monitored. Signs and symptoms of local anesthetic toxicity were looked for. No sedation was given to patients intraoperatively. If patient complained of pain intraop then analgesia supplied with i.v. fentanyl 40 ug intermittently.

Postoperatively: All patients were kept under observation for 24 hrs. Duration of sensory and motor blockade was noted. Duration of sensory block was taken from complete onset of sensory block till the patient complains of pain. Duration of motor block was taken as the time from complete loss of finger movements till the patients starts moving his fingers. Postoperative analgesia was given when pain score was more than 40. Patients pulse, blood pressure, saturation and respiratory rate were monitored and specially signs and symptoms of local anesthetic toxicity and complications of supraclavicular block like pneumothorax, nerve damage etc were looked for. .

Statistical analysis

Results are expressed as mean ± standard deviation. A unpaired students 't' test was used to compare changes at two sample points in

different groups. Two way analysis of variance (ANOVA) with multiple range test was used to identify statistically significant changes in different variable in relation to different sample points. A 'p-value' of less than 0.05 was considered significant.

Results

Supraclavicular brachial plexus block was studied in 60 patients during the period oct-2007 to oct-2008 for elective and emergency upper limb surgeries. The observations made in the study are recorded in the tables given below:

Table 1:Latency & Duration of Sensory & Motor block

	Group	Range	Mean ± SD	P-value
Latency of sensory block (Min)	I	8-18	12.65±3.25	I & II = 0.228
	II	9-18	13.8±2.78	I & III = 0.001
	III	10-25	18.45±3.51	II & III = 0.01
Latency of motor block(Min)	I	6-24	9.65±4.45	I & II = 0.221
	II	7-25	11.55 ± 5.16	I & III < 0.05
	III	9-29	19.65± 5.64	II & III < 0.05
Duration of sensory block (Hrs)	I	6-12	8.05±1.27	I & II = 0.75
	II	6-12	8.2±1.67	I & III = 0.002
	III	5-9	6.75±0.96	II & III = 0.003
Duration of motor block (Hrs)	I	5-9	6.65±1.26	I & II = 0.715
	II	5-8	6.75±0.91	I & III = 0.149
	III	5-8	6.1±0.96	II & III > 0.05

From the above table we came to know that latency for sensory block was minimum with group I (12.65±3.25mins) and maximum with group III (18.45±3.51mins). There was not found statistically significant difference between group I & II (p-value = 0.228) but was found to have statistically significant difference between II & III (p-value = 0.001) and I & III (p-value = 0.01) sensory block latency. Similar results were shown for the motor block latency. Also, when compared duration of sensory block, it was found that sensory block was for maximum 8.05±1.27 hrs in group I and minimum 6.75±0.96 hrs in group III. There was found to be statistically significant difference between group II & III (p-value = 0.002) and I & III (p-value = 0.003) but there was no statistically significant difference between I & II (p-value = 0.75) for duration of sensory block. Also, when noticed the duration of motor block in all three groups, it was found to have no statistically significant difference between the groups. [I & II (p-value = 0.715), II & III (p-value = 0.149), I & III (p-value > 0.05)]

Table 2:Showing the postoperative pain score & sedation score

	Groups	Mean± S.D.	Range	p-value
Sedation score	I	1.20±0.23	1-3	I & II = 0.59
	II	1.17±0.20	1-2	I & III = 0.02
	III	1±0	-	II & III = 0.04
Postoperative pain score	I	40±14.87	20-90	I & II = 0.55
	II	42.65±14.64	30-80	I & III < 0.05
	III	66.5± 10.77	50-90	II & III < 0.05

When evaluated for the sedation score, it was found that there was statistically significant difference between the sedation in group II & III (p-value = 0.02) and I & III (p-value = 0.04) but there was no statistically significant difference between I & II (p-value = 0.59). Again, it was found that group I had minimum post-operative pain score of 40±14.87 and was maximum with group III 66.5± 10.77. There was not found statistically significant difference between group I & II (p-value = 0.55) but was found to have statistically significant difference between II & III (p-value < 0.05) and I & III (p-value < 0.05) for post-operative pain score. Thus, we came to know that intervention in group I & II provide better sedation & post-operative pain relief than group III.

Table 3: Showing the blood pressure variation

Groups	Blood pressure(systolic) mmhg			
	Preop	Intraop	Postop	Range (p value)
I	120±10.7	116±4.89	116±4.87	100-140 (0.148)
II	115.9±4.96	120±9.60	119.5±8.71	100-140 (0.219)
III	126± 9.94	121.5 ± 10.7	120±10.4	100-140 (0.171)

Above table showed the pre, intra & post-operative changes in blood pressure in all three groups. It was found that all the group did not show the statistically significant difference between themselves (p-value > 0.05).

Table 4: Showing the pulse/min variation

Groups	Pulse/min			
	Preop	Intraop	Postop	Range(P value)
I	79.3 ± 6.4	79.69 ±1.1	76.93 ±1.2	68-90 (0.058)
II	78.3 ±8.42	80.1 ±7.55	77.8 ±0.62	65-98 (0.508)
III	78.1 ± 6.6	77.7 ± 6.1	79.1 ± 6.2	66-98 (0.770)

From the above table we came to know that there were no statistically significant difference for the pulse/min in the group and in between the group. Thus, we could say that all the three intervention did not have significant difference for the pulse.

Discussion

From our study it was evident that onset of sensory block was comparatively faster in group I (12.65±3.25) min and group II (13.8±2.78) min where midazolam intervention was given than group III (18.45±3.51) min i.e. group containing mixture of lignocaine and bupivacaine only. There was not found statistically significant difference between group I & II (p-value = 0.228) but was found to have statistically significant difference between II & III (p-value = 0.001) and I & III (p-value = 0.01). Again the similar trend was seen for the onset of motor block where it was quickest in group I (9.65±4.45min) and longest in group III (19.65± 5.64min). It was found to have statistically significant difference in between group I & III and II & III (p-value < 0.05 each). Also, when compared duration of sensory block, it was found that sensory block was for maximum 8.05±1.27 hrs in group I and minimum 6.75±0.96 hrs in group III. There was found to be statistically significant difference between group II & III (p-value = 0.002) and I & III (p-value = 0.003) but there was no statistically significant difference between I & II (p-value = 0.75) for duration of sensory block. Also, when noticed the duration of motor block in all three groups, it was found to have no statistically significant difference between the groups. [I & II (p-value = 0.715), II & III (p-value = 0.149), I & III (p-value > 0.05)]. The study conducted by Jarbo et. al onset of sensory blockade (12±2.9) min and motor blockade (9.2±2.38) min which was significantly faster in group containing mixture of bupivacaine and midazolam than group containing only bupivacaine which is similar to my study results. Also, study conducted by Laiq N, Khan MN,et al [23] observed that onset of sensory block (14±3.1min) and motor block(10.5±2.40min) was significantly faster and longer in group B where midazolam was used compared to group A where only bupivacaine was used (onset of sensory block(22±3.5min) & onset of motor block (18.5±3.50min),(p<0.001). Thus, addition of midazolam may have better & faster effect for the onset and duration of sensory and motor block.From table no. 2 we came to know that in our study we found higher mean sedation score in group I (1.20±0.23) and group II (1.17±0.21) than group III (1±0). The difference in sedation score between group II and III is statistically significant (p value= 0.04). Thus in our study the sedation score were higher in patients who received midazolam with local anesthetics. These findings are consistent with study conducted by Jarbo et al in 2005, in which they observed statistically significant difference in sedation score between groups containing bupivacaine + midazolam (sedation score 2) and group containing bupivacaine alone (sedation score 1). In our study we found mean sedation score of 1.20±0.23 & 1.17±0.20 in group I & II respectively. Though the difference in sedation score were statistically significant between group I & III and between groups II & III, we did not observed clinically significant sedation in groups I & II i.e. the maximum sedation score was 3 in group I in only one patient. Similar findings were also observed by Laiq N, Khan MN,et al[23] in 2008. They also observed statistically significant difference in sedation score between groups containing bupivacaine + midazolam and group containing bupivacaine alone. In our study postoperative pain score was maximum in group III(66.5± 10.77) and minimum in group I (40±14.87) and group II have intermediate pain score(42.65±14.64). However the difference in pain score between group I and II is statistically not significant (p value= 0.55) but the difference in pain score between group I & III (p value<0.05) and between group II & III (p value<0.05) are statistically significant. The study conducted by Jarbo et al 2005[22] (2005) observed higher pain score in group with only bupivacaine as compared to group bupivacaine plus midazolam at different time interval. In our study we also found higher pain score in group III i.e. (lignocaine+bupivacaine only). We found decreased pain score in midazolam containing groups as compared to above study in 24 hour duration. Thus from above studies it is clear that addition of midazolam with local anesthetics reduces postoperative pain score to a statistically significant level. Table no. 3 & 4 showed that pulse, blood pressure were maintained within normal range and the mean preop, intraop, postoperative values did not differ significant statistically in the patients of all the three groups. This shows that the vitals were well maintained in all the patients of all the three groups. The study conducted by Jarbo et al 2005[22] and Laiq N, Khan MN et al 2008[23] observed that there are no statistically significant variation in mean pulse, blood pressure throughout the observation period.

Conclusion

The present study was conducted to evaluate the efficacy of midazolam added with lignocaine and bupivacaine during brachial plexus block. Total 60 participants were divided into 3 groups group I receiving 40ml of mixture of (20ml of 1.2% lignocaine + midazolam 50ug/kg) and 20 ml of 0.5% bupivacaine, group II receiving 40 ml of mixture of 20ml of 1.2% lignocaine and (20 ml of 0.5% bupivacaine +midazolam 50ug/kg) and group III receiving 40 ml mixture of 20ml of 1.2% lignocaine +20 ml of 0.5% bupivacaine. The latency for sensory block was minimum with group I (12.65±3.25mins) and maximum with group III (18.45±3.51mins). Also, when compared duration of sensory block, it was found that sensory block was for maximum 8.05±1.27 hrs in group I and minimum 6.75±0.96 hrs in group III. For the both factors there was found to have statistically significant difference between group I & III, II & III. When evaluated for the sedation score, it was found that there was statistically significant difference between the sedation in group II & III (p-value = 0.02) and I & III (p-value = 0.04) but there was no statistically significant difference between I & II (p-value = 0.59). Again, it was found that group I had minimum post-operative pain score of 40±14.87 and was maximum with group III 66.5± 10.77. Also, we observed that there were no statistically significant variation in mean pulse, blood pressure throughout the observation period.

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