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COMPARISON OF CLONIDINE OR FENTANYL AS AN ADJUVANT TO BUPVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES: A RANDOMIZED DOUBLE BLIND, CONTROLLED INTERVENTIONAL STUDY

Anaesthesiology

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ABSTRACT

Background The popularity of supraclavicular brachial plexus block in upper limb surgery in recent years are due to better understanding of using adjuvant to local anaesthetics, its advantages and in avoidance of the hazards of general anaesthesia.

Aim To compare anaesthetic and analgesic properties of clonidine or fentanyl as an adjuvant to bupivacaine in supraclavicular brachial plexus block in upper limb surgeries.

Method A total number of 90 patients (ASA class 1 and II) were selected randomly into three groups, thirty in each group. Group-A (control group) received bupivacaine (0.25%) 28ml and 2ml 0.9% Ns, total of 30ml. Group-B (study group) received fentanyl (100µg) 2ml and bupivacaine (0.25%) 28ml, total of 30ml. Group-C (study group) received clonidine (150µg) 2ml and bupivacaine (0.25%) 28ml, total of 30ml.The parameters including pulse rate, non invasive systolic and diastolic blood pressure, respiratory rate, SpO2, onset and duration of motor and sensory block, postoperative pain score in VAS, duration of analgesia, first analgesic demand, side effects were assessed and recorded.

Result The difference in onset of sensory & motor block (early in clonidine group), duration of sensory & motor block and duration of analgesia (prolonged in clonidine group) was found to be statistically significant between all the groups ($p<0.05$). But intensity of pain measured by VAS in group A was highest at 18 hrs group-B and group-C expressed highest at 24 hours of postoperative period with group C showing lower VAS. Duration of analgesia (time from supraclavicular block to first analgesic demand) in study group-C had significantly longer mean duration than that produced by Group B and control group-A (18.2 ± 2.5 vs 15.4 ± 1.2 and 8.2 ± 1.3 hours $P<0.001$).

Conclusion Clonidine and bupivacaine combination is a better alternative to fentanyl and bupivacaine in respect of quality of anaesthesia and duration of analgesia.

KEYWORDS

Supraclavicular, clonidine, fentanyl, brachial plexus block, bupivacaine

INTRODUCTION

Regional nerve block avoids the unwanted effects of anaesthetic drugs used during general anaesthesia and the stress response of lanryngoscopy and tracheal intubation. Brachial plexus block serves as the sole regional anaesthetic technique to facilitate painless surgery in the upper limb and is close to the ideal anaesthetic technique. It provides an excellent alternative for the patients who are at high risk for general anaesthesia.

Various approaches have been described for brachial plexus block of which the supraclavicular approach is the most consistent and time efficient as it blocks all the branches of the brachial plexus. It has a high success rate and rapid onset of action. It provides analgesia without sedation, prolonged postoperative analgesia and allows early patient's discharge. Pneumothorax (1-6%), hemothorax, Horner's syndrome and phrenic nerve block are the potential complications. [1,2]

For early onset of block, for prolonged postoperative analgesia and for reducing the requirement of local anaesthetic agents various adjuvants are used. Clonidine & dexmedetomidine are commonly used adjuvant in brachial plexus blocks. [3,4,5]

Clonidine appears to have significant analgesic benefit and to cause minimal adverse effects when added in a dose up to 150µg. [6,7] Fentanyl added to elbow, forearm and hand surgery because all the branches of brachial plexus can be reliably blocked. [8] Now-a -days different drugs have been used as an adjuvant with local anaesthetic in brachial plexus block to achieve quick, dense and prolonged block. [9]

On the basis of studies of related literature and discussion made above, it may be thought that bupivacaine- clonidine is a better alternative to bupivacaine-fentanyl for supraclavicular brachial plexus block.

In this study we have evaluated the quality, onset, duration of anaesthesia and analgesic effects of clonidine in bupivacaine as compared to fentanyl in bupivacaine in supraclavicular block for upper limb surgery.

METHODOLOGY

This was a hospital based prospective interventional randomized double blind controlled study. Study was approved by the research and review board of our medical college. Due permission from the institutional ethical committee was taken and informed written consent from all the patients undergoing study was also obtained before the study.

All patients (male/female) were of ASA class 1 or 2, 50-70 kgs of weight, 18-60 years of age, undergoing elective surgery on upper limb which took 1-4 hours duration. Patients not willing to participate in the study, uncooperative patient, local pathology at the injection site, allergy to any of the drug, bleeding disorders /coagulopathies, history of respiratory distress and/or contralateral pneumothorax were excluded from the study.

Sample size:

As in study of Ahmed et al (10) expecting minimum detectable difference in mean duration of analgesia in both the group 3.5 ± 1.5 hrs, the sample size was calculated 19 subjects for each group at alpha error 0.05 and power 80%. In our study we included 30 patients in each group.

Group A (n=30) Control group = received 28 ml bupivacaine 0.25% with 2ml 0.9% NS

Group B (n=30) received 28 ml bupivacaine 0.25% and fentanyl (100mcg) 2 ml.as an adjuvant.

Group C (n=30) received 28 ml bupivacaine 0.25% and clonidine (150mcg) 2 ml as an adjuvant.

The patients were randomly assigned into either group using a sealed envelope technique. Patients, surgeons and anaesthesiologist who were involved in the patient's clinical assessment and treatment were blinded to the group assignment.

The brachial plexus block with classical supraclavicular approach was

given in all the patients. Vitals (heart rate, blood pressure, respiratory rate and oxygen saturation) were recorded at 10 minutes interval intraoperatively.

After injecting the drug sensory block was tested by pin prick and motor block by ability to move the upper limb, in every 2 minutes till the onset of block. Onset of sensory block was defined when there is no pin prick sensation in shoulder area & motor block onset is defined when patient was unable to move shoulder joint. Time to onset of sensory & motor block was recorded.

Duration of sensory block was considered the time from loss of pin prick sensation to return of this sensation. Duration of motor block was taken as time between onset of motor block to return of movements at elbow joint.

Duration of sensory & motor block and duration of analgesia (VAS score) with degree of sedation (Table 3) were also recorded.

Pain score (visual analogue score) was recorded at 30 min, 1,3, 6, 12, 18 and 24 hours after completion of the surgery. When VAS recorded was >4, inj. diclofenac 75 mg was given intravenously as rescue analgesic and considered as duration of analgesia.

A close monitoring of the patients was done throughout the procedure to look for any other complication.

Statistical Analysis:
Collected data were analysed using SPSS version 23 software. Quantitative data was expressed as mean ± SD. To assess any significant association ANOVA test and Tukey test were used. Significance level was considered at $p<0.05$.

RESULTS

In this study satisfactory surgical anaesthesia was attained in all the cases. The demographic and baseline hemodynamic parameters were comparable in all the groups ($p>0.05$) (Table 1).

The mean onset of sensory block for Group A was 12.8±2.4 (min.), for Group B was 9.1±1.9 (min.) and for Group C was 8.9 ±1.0 (min.).

This difference between all the groups was found to be statistically very significant ($p < 0.01$).

The mean onset of motor block for Group A was 15.3±2.2 (min.), for Group B was 11.8±2.2 (min.), and for Group C was 12.3±1.3 (min.).

This difference was found to be statistically significant between all the groups ($p<0.05$).

Table 1: Demographic data and baseline hemodynamic variables Age and weight expressed as (Mean + SD)

	GROUP A	GROUP B	GROUP C
Age (yrs.)	32.5±9.8	30.3±10.9	32.4±9.3
Sex (M,F)	23,7	27,3	27,3
Weight (kg)	60.03±6.09	56.86±6.07	60.33±5.94
ASA grade (I,II)	27,3	27,3	24,6

The mean duration of sensory block in Group A was 387.8 ± 43.8 (min), in Group B was 561.5 ± 33.7 (min) and in Group C was 573.2 ± 35.6 (min). On applying ANOVA test p was <0.01 (statistically significant).

The mean duration of motor block in Group A was 388.8 ± 47.1 (min), in Group B was 477.8 ± 27.3 (min) and in Group C was 508.8 ± 32.3 (min).

The p value was <0.001 between the groups (significant).

Then total duration of analgesia in Group A was 454.5 ± 51.4 (min), in Group B was 661.7 ± 30.5 (min) and in Group C was 698 ± 35.6 (min). On applying ANOVA test p was <0.001 (statistically significant).

Table 2: Block (Sensory & motor) and Analgesia. Values are (Mean + SD)

	GROUP A	GROUP B	GROUP C
Onset of sensory block (min)	12.8±2.4	9.1±1.9	8.9 ±1.0
Onset of motor block (min)	15.3±2.2	11.8±2.2	12.3±1.3
Total duration of analgesia (min)	454.5 ± 51.4	661.7 ± 30.5	698 ± 35.6
Duration of sensory block (min)	387.8 ± 43.8	561.5 ± 33.7	573.2 ± 35.6
Duration of motor block (min)	388.8 ± 47.1	477.8 ± 27.3	508.8 ± 32.3

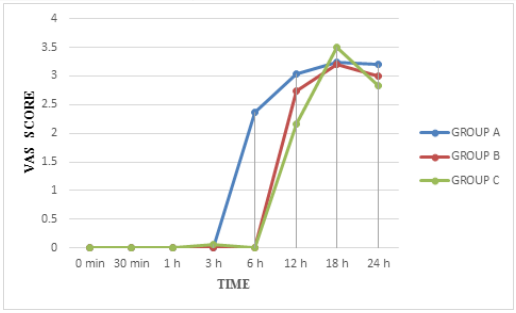

Figure 1. Comparison of post-operative pain VAS between Group-A, Group-B and Group-C

VAS score was significantly different between group after 12 hours. The pain was high in group-A as compared to other groups.

Effect on heart rate, systolic & diastolic BP (intraoperative & postoperative): Tukey's test was applied and found significant difference between group A and C & group C and C ($p<0.05$). No significant difference between group A and C was seen ($p>0.05$).

Effect on respiratory Rate & oxygen saturation: Tukey's test was applied and found no statistically significant difference ($p >0.05$) in intraoperative and postoperative period.

There was no respiratory depression, nausea, vomiting or any other adverse effect in any patient in the intraoperative and postoperative period.

DISCUSSION

Clonidine is a selective partial agonist for α2 adrenergic receptors and it is the most studied drug used for neuraxial anaesthesia. It is more potent after neuraxial than systemic administration indicating spinal site of action and favoring neuraxial administration. It is moderately lipid soluble, easily penetrates the blood brain barrier leading to spinal and supra spinal receptor binding and thus provides effective and long lasting post-operative analgesia. Recently, clonidine has also been shown to increase acetylcholine (Ach) levels in lumbar cerebrospinal fluid, as cholinergic activation imparts analgesia. It may also cause local vasoconstriction. Intrathecal α2 agonists are found to have antinociceptive action for both somatic and visceral pain.

Fentanyl is a lipophilic μ receptor agonist opiod. Intrathecally It exerts its effect by combining with opioid receptor in the dorsal horn of spinal cord and may have a supraspinal spread and action. The effectiveness of Intrathecal opioids depends on their bioavailability, so opioids can provide good perioperative analgesia.

In our study, we compared clonidine and fentanyl in terms of safety and efficacy, and to compare the efficacy, we used the effective analgesia duration measured in minutes for requirement of rescue analgesia.

There was no significant difference between the two groups in terms of demographic data and duration of surgery.

In present study means onset time for sensory block was 12.8±2.4 min, 9.1±1.9 min and 8.9±1.0 min in group-A, B, and C respectively. Similarly, mean onset time for motor block was 15.3±2.2 min, 11.8±2.2 min, and 12.3±1.3 min in group-A, B and C respectively with clonidine group showing faster onset times. There was statistically significant difference between Group-A-B, Group-A-C and but no significant difference was found between group-B-C. Thus, the addition of fentanyl or clonidine hastens the onset of sensory block and time to reach the peak sensory level significantly. [10]

In present study duration of Sensory Block (min) was 387.8±43.8 min,

561.5±33.7 min, and 573.2±35.6 min in group-A, B, C respectively. Duration of Motor Block (min) was 388.8±47.1 min, 477.8±27.3 min, and 508.8±32.3 min in group-A, B, and C respectively. Santvana Kohli et al [11] & Bernard et al [12] found that clonidine decrease the onset of sensory and motor block and increase the duration of sensory and motor block and post- operative analgesia as compared to bupivacaine and lidocaine alone, which is also consistent with our study.

There, were no significant changes in heart rate, systolic blood pressure and diastolic blood pressure, mean arterial pressure, SPO2 and motor power in all the three groups, although the difference was comparable with high value in group-A as compared to other two groups. In concordance with this study by Routray et al[13] also found that there was also no significant difference regarding hemodynamic parameters such as systolic blood pressure, diastolic blood pressure and heart rate. Bhure et al [14] demonstrated that addition of clonidine, fentanyl, to bupivacaine significantly improves the onset and duration of sensory and motor block with relative hemodynamic stability.

In present work, VAS score was significantly different between group after 12 hours. The pain was high in group-A as compared to other groups. This was supported by the study of Total duration of analgesia in our study was 454.5±51.4 min, 661.7±30.5 min, and 698±35.6 min in Group-A, B, C respectively. Thus, clonidine is an effective adjuvant to bupivacaine. The precise mechanism of topical clonidine is not yet established. It has been attributed to the fact that sympathetic neural activity and norepinephrine have an excitatory effect on nociceptive discharge after cutaneous injury. Since clonidine inhibits the norepinephrine release from prejunctional α2-adrenoceptors in the periphery, it may inhibit nociceptive pathway activity. Other possible mechanisms are enhancement of effect of local anaesthetics by selectively blocking the Aδ and C fibers, and also by release of enkephalin-like substance. [15] Rajkhowa et al. [16] mentioned in their study on fentanyl as adjuvant in brachial plexus nerve block that the mechanism of fentanyl in prolongation of analgesia may be due to the existence of peripheral functional opioid receptors.

We also found that total dose of analgesic consumption was higher in group-A (92.5±42.6 mg) as compared to group-B (77.5±36.7 mg) and Group-C (72.5±57.3 mg).

CONCLUSION

Supraclavicular brachial plexus block with bupivacaine and clonidine causes early onset of sensory& motor block. It is highly effective in prolonging the duration of sensory & motor block and postoperative analgesia with better quality of block as compared to bupivacaine with or without fentanyl. No significant side effects were noted. So clonidine is better adjuvant than fentanyl in supraclavicular brachial plexus block.

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