



Comparison of three Different Doses of Dexmedetomidine as Adjuvant to Bupivacaine in Supra Clavicular Brachial Plexus Block for Upper Limb Orthopaedic Surgeries A Study of 60 Cases

Muthu
Shenbagam

Associate Professor, Department of Anaesthesiology, Kanyakumari Government Medical College, Nagercoil, Tamil Nadu

B. Dhanalakshmi

198/4, Murugan Nilayam, High School Road, Velur (Post), P. Velur (tk) Namakkal Dist, Tamil Nadu, India

ABSTRACT

Objective: The aim and objective of the study is to compare the three different doses of dexmedetomidine and to know the optimal dose of dexmedetomidine as adjuvant to bupivacaine in supra clavicular brachial plexus block for upper limb orthopedic surgeries.

Methods: We studied 60 ASA I & II patients undergoing upper limb orthopaedic surgeries including fracture humerus and fracture radius and ulna under supra clavicular brachial plexus block done by paresthesia technique. Patients were randomly allocated to three groups. Group A: (n-20) – 30 ml 0.33% bupivacaine + dexmedetomidine 50mcg. Group B: (n-20) – 30ml 0.33% bupivacaine + dexmedetomidine 75mcg. Group C: (n-20) – 30ml 0.33% bupivacaine + dexmedetomidine 100mcg. Patients were evaluated for sensory & motor block onset and duration, duration of analgesia, sedation score, complications, hemodynamic parameters including non-invasive blood pressure, pulse rate, saturation intra operatively and post operatively.

Results: Sensory block onset was longer in group A (16.3±3.31) than group B (12.4±2.5) which is longer than group C (7.35±1) and motor block onset also longer in group A (20.4±2.7) than group B (16.15±2.89) which is longer than group C (12.15±2.81). The duration of both sensory and motor block was longest with group C (sensory mean 722.5±55.1 minutes, motor mean 704±41.4 minutes) compared with group B (sensory mean 625.5±72.7 minutes, motor mean 604±98.6 minutes) which is longer than group A (sensory mean 432±69.8 minutes, motor mean 426.5±81.8). The mean duration of analgesia was dose dependent (table B5) with C (736±67.1) > B (642±76.5) > A (480.5±81.3) minutes.

Conclusion: We conclude that dexmedetomidine 100µg is an optimal dose to provide prolonged post-operative analgesia without significant side effects

KEYWORDS : Dexmedetomidine, Supra clavicular, Brachial plexus block

INTRODUCTION

Local anesthetics developed in first half of 20th century were amino ester compounds with unfavorable properties of short duration of action, systemic toxicity and allergic reactions. This led to advent of long acting amino amide compounds. The drawbacks of which are delayed onset of action, varying quality of blockade and inadequate post-operative analgesia.

Adjuvants are added to local anesthetics in peripheral nerve blocks to fasten the onset of action, to prolong the duration of action and improve the quality of blockade.

Various adjuvants like morphine, fentanyl, sufentanil, clonidine, midazolam, ketamine, neostigmine are added to local anesthetics. Previously, clonidine the α_2 agonist was used as adjuvant to local anaesthetic which was associated with adverse effects like hypotension and bradycardia. In our study dexmedetomidine, the other drug belongs to α_2 agonist is used as an adjuvant to potentiate the action of local anaesthetics. Since dexmedetomidine has $\alpha_2:\alpha_1$ selectivity ratio of 1620:1 as compared to 220:1 for clonidine, it decreases unwanted side effects of α_1 and much more sedative and analgesic. This study is designed to compare the effect of three different doses of dexmedetomidine when added to bupivacaine in brachial plexus block.

AIM OF THE STUDY

The aim and objective of the study is to compare the three different doses of dexmedetomidine and to know the optimal dose of dexmedetomidine as adjuvant to bupivacaine in supra clavicular brachial plexus block for upper limb orthopedic surgeries.

MATERIALS AND METHODS

This study was carried out in the orthopaedic surgery theatre, Kanyakumari government medical college after obtaining institutional ethical committee approval. The aim was to compare the effect of three different dose of dexmedetomidine as adjuvant to bupivacaine in supra clavicular brachial plexus block in terms of Onset and duration of sensory block, onset and duration of motor block, duration of analgesia, peri-operative hemodynamics, complications.

Study design: This was a randomized, prospective, double blinded study.

The study has started after receiving Institutional Ethical Committee approval and informed written consent from all the patients.

Randomisation: Simple randomized sampling was done by computer generated random numbers.

Sample Size: Sixty patients were studied.

Group allocation: Patients were allocated into three groups:

Group A (n-20) – 30 ml 0.33% bupivacaine + dexmedetomidine 50mcg

Group B (n-20) – 30ml 0.33% bupivacaine + dexmedetomidine 75mcg

Group C (n-20) – 30ml 0.33% bupivacaine + dexmedetomidine 100mcg

Masking: The anaesthesiologist who administered the drug and the observer were blinded to the study. Local anaesthetic, study drug mixture was prepared by another anaesthesiologist not participating in the study. The intra operative monitoring and post-operative observation was done by the same anaesthesiologist who administered the drug, who was unaware of the group allocation

Inclusion Criteria:

Age – 20-60 years

Weight – 50-70 kg

ASA I & II

Written informed consent

Upperlimb orthopedic surgeries

Exclusion Criteria:

Consent not given

Significant neurological disease

Psychiatric disorder

Pregnancy and lactation

Patients on anticoagulation

Significant systemic disorder
 Known hypersensitivity to study drugs
 Patients on adrenergic drugs

METHODS

Pre Operative Preparation: Patients were pre operatively assessed and procedure was explained to the patient regarding the technique and consent obtained.

Supraclavicular brachial plexus block: Patient were positioned supine with the head turned away from the side to be blocked and the ipsilateral arm adducted. The neck was prepared with povidone iodine solution and draped with sterile towels.

Supraclavicular brachial plexus block was done by subclavian perivascular technique – paraesthesia technique.

Procedure: Under strict aseptic precautions after local infiltration of 2% lignocaine, a 22G short beveled needle is inserted in the interscalene groove 1 to 1.5 cm above the clavicle and directed towards ipsilateral nipple posteriorly and caudally. After elicitation of paraesthesia the local anaesthetic drug mixture injected after repeated aspiration.

Evaluation of block: The following observations were made:

Vital signs monitoring -heart rate, non-invasive blood pressure, oxygen saturation and sedation score were measured every minute for the first 5 minute and every 5 minutes for 1 hour, every 15 minutes thereafter until the end of surgery& in the post-operative period. For statistical purposes they were documented at 0,5,10,15,30,45,60,90,120,150 minutes. Immediately following the administration of the drug, patient was evaluated for the onset of sensory and motor blockade every minute.

Onset time for sensory block – time from completion of injection to loss of cold and pain sensation (score 2)

Loss to cold sensation using alcohol swab in all dermatomes of brachial plexus. Atraumatic pin prick test

- Score 0: normal sensation
- Score 1: loss of sensation to pin prick
- Score 2: loss of sensation to touch

Onset time for motor block -- Time from completion of injection to complete motor blockade with inability to move fingers

Sedation was assessed by modified Ramsay sedation scale .

Only patients with complete sensory & motor blockade are included in the study. Failure of block to be established even after 20 minutes was taken as block failure. Block failure patients managed with local anaesthetic supplementation or general anaesthesia as appropriate and those patients excluded from the study.

Sedation is assessed using Ramsay Sedation score and if the patient is anxious even 1 hr after blocking the plexus, 1mg midazolam was given to achieve a sedation score of 2-3. When the saturation falls below 92% supplemental O2 was given.

Patients were monitored for local anaesthetic toxic reactions including subjective and objective manifestations like circumoral numbness, tinnitus, twitching, and convulsions.

Patients were also monitored for complications associated with the technique, drug like intravascular injection, Intrathecal injection, pneumothorax, hypotension & bradycardia.

Post-operative ly heart rate, NIBP, Oxygen saturation, sedation score recorded at 0,30,60 min, 2 hr, 3 hr, 4 hr, 6 hr, 12 hr, 24 hr.

Duration of sensory block – time from injection of local anaesthetic to complete recovery from cold and pain sensation in all dermatomes.

Duration of motor block – time from injection of local anaesthetic to

complete recovery of motor function modified bromage scale score 0.

Duration of Analgesia – time from onset of sensory block to VAS score 4.

Inj. Diclofenac 75mg intramuscularly is given as a rescue analgesic when the pain score is more than 4.

Patients were followed for upto 24 hrs for any adverse effects

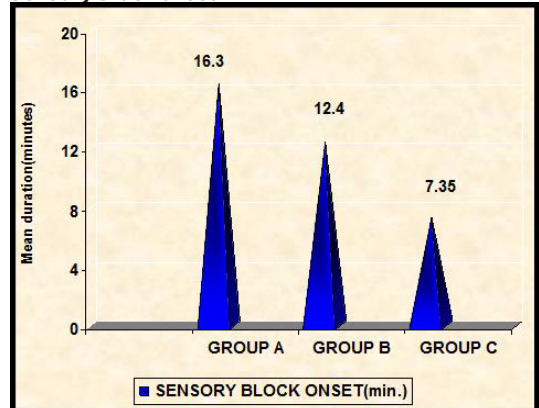
RESULTS

Statistical Tools: The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2010) developed by Centre for Disease Control, Atlanta.

Using this software range, frequencies, percentages, means, standard deviations, chi square , 'F' value and 'p' values were calculated. ANOVA test was used to test the significance of difference between quantitative variables and Yate's and Fisher's chi square tests for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

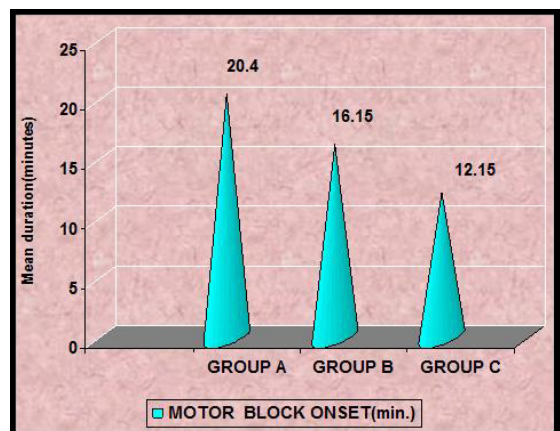
- Group A: Dexmed 50 mcg**
- Group B: Dexmed 75 mcg**
- Group C: Dexmed 100 mcg**

Sensory Block onset



The mean onset time of group A was significantly longer than group B which was significantly longer than group C. A (16.3±3.31) >B(12.4±2.5) >C(7.35±1)

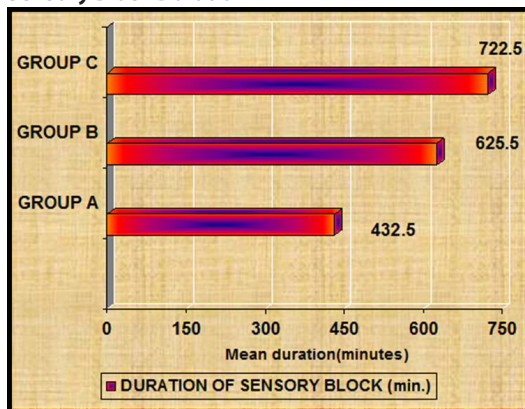
Motor Block onset



The mean onset time of group A was significantly longer than group B which was significantly longer than group C.

A(20.4±2.7) >B(16.15±2.89) >C(12.15±2.81)

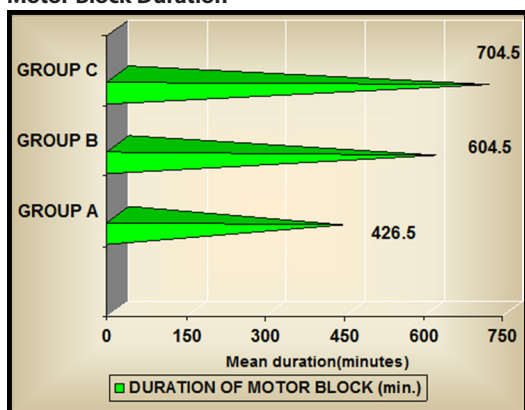
Sensory Block Duration



The mean duration of sensory block of group C was significantly longer than group B and group B was significantly longer than group A.

$C(722.5 \pm 55.1) > B(625.5 \pm 72.7) > A(432.5 \pm 69.8)$

Motor Block Duration



The duration of motor block of group C was significantly higher than group B and group B was significantly higher than group A.

$C(704.5 \pm 41.4) > B(604.5 \pm 98.6) > A(426.5 \pm 81.8)$

Duration of Analgesia

The mean duration of analgesia of C group was significantly longer than the B group and B group was significantly longer than the A group.

$C(736 \pm 67.1) > B(642 \pm 76.5) > A(480 \pm 81.3)$

Sedation Score

The C group achieved more sedation level than group B and group B achieved more sedation level than group A.

$C(4.65 \pm 10.4) > B(3.8 \pm 1.15) > A(2.95 \pm 1.05)$

Complications

Bradycardia and Hypotension were the only adverse effects noted and was much associated with the group C. But the association within the groups did not have any statistical significance ($P > 0.05$)

DISCUSSION

Several researches have revealed that the administration of an α_2 adrenergic agonist in the peripheral nerve blockade produces prolonged post-operative analgesia without much complications. Several mechanism have been hypothesized to explain the analgesic effect of α_2 adrenergic agonist including complex interaction with axonal ion channels which result in direct suppression of impulse propagation, vasoconstriction around injection site and local release of encephalin like substances.

Studies have shown that clonidine when added to bupivacaine in brachial plexus block prolongs the duration of analgesia but was associated with side effects such as hypotension, bradycardia and respiratory depression. Several animal studies have been investigated the effect of dexmedetomidine as adjunct to local anaesthetics. Brummett & colleagues reported that dexmedetomidine added to ropivacaine in sciatic nerve block provided prolonged analgesia than systemic administration. Another study conducted by Brummett and colleagues discovered that dexmedetomidine added to bupivacaine prolong sensory & motor block duration however it alone failed to show significant sensory & motor blockade.

Recently there are several study available using dexmedetomidine as adjunct to various local anaesthetics in central neuraxial blockade and peripheral nerve blockade. There are many studies available with various dose of dexmedetomidine as adjuvant to local anaesthetics in supra clavicular brachial plexus block. In our study we designed to compare the three doses

50 μ g, 75 μ g, 100 μ g of dexmedetomidine to know the optimal dose in supra clavicular brachial plexus block for upper limb orthopedic surgeries.

Demographic characters like age, sex, weight, duration of surgery were comparable in all three groups. In our study we observed that sensory block onset was longer in group A (16.3 \pm 3.31) than group B (12.4 \pm 2.5) which is longer than group C (7.35 \pm 1)(table B1) and motor block onset also longer in group A (20.4 \pm 2.7) than group B (16.15 \pm 2.89) which is longer than group C (12.15 \pm 2.81) (table B2). So we conclude that onset of sensory & motor blockade was earlier as the dose increases. These observations were comparable with Agarwal S et al, in their study earlier onset of blockade with 100 μ g dexmedetomidine but different from Yu zhang et al, in their study there is no significant difference in sensory and motor block onset between dexmedetomidine 50 μ g and 100 μ g group.

The duration of both sensory and motor block was longest with group C (sensory mean 722.5 \pm 55.1 minutes, motor mean 704 \pm 41.4 minutes) compared with group B (sensory mean 625.5 \pm 72.7 minutes, motor mean 604 \pm 98.6 minutes) which is longer than group A (sensory mean 432 \pm 69.8 minutes, motor mean 426.5 \pm 81.8). So we conclude that sensory & motor block duration is longer as the dose increases. This observation is comparable with previous studies Yu zhang et al who observed the duration of sensory and motor block significantly differ between groups and Agarwal S et al. The mean duration of analgesia was dose dependent with C (736 \pm 67.1) > B(642 \pm 76.5) > A(480.5 \pm 81.3) minutes. This is also comparable with the other studies Yu zhang et al, Agarwal S et al and Amany S Ammar. The sedation was also dose dependent with group C achieved more sedation than group B who achieved more sedation than group A. In respect of complications bradycardia and hypotension were the only adverse effects noted and was much associated with the group C. But the association within the groups did not have any statistical significance ($P > 0.05$). This observation is coinciding with Sawmya Biswas et al and Sandhya Agarwal et al but differ from Yu Zhang et al. The statistical analysis of intra operative and post-operative hemodynamic variables such as PR, SBP, DBP, SPO₂ between the three groups showed no statistically significant hemodynamic fluctuation.

CONCLUSION

Dexmedetomidine, added to bupivacaine in supra clavicular brachial plexus block for upper limb orthopedic surgeries, has a dose dependent effect on the sensory and motor blockade, with earlier onset and increased duration of blockade and prolonged post-operative analgesia, gives better level of sedation and provides stable hemodynamic control during the intra operative period.

Dexmedetomidine 100 μ g is an optimal dose to provide prolonged post-operative analgesia without significant side effects.

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