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Original Research Paper

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COMPARISON OF THREE DIFFERENT DOSES OF DEXMEDITOMIDINE AS ADJUVANT TO BUPIVACAINE IN SUPRA CLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB ORTHOPAEDIC SURGERIES

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ABSTRACT

Background and goals of study: The aim and objective of the study is to compare the three different doses of dexmeditomidine and to know the optimal dose of dexmeditomidine as adjuvant to bupivacaine in supra clavicular brachial plexus block for upper limb orthopedic surgeries. **Methods:** We studied 60 ASA 1 & 11 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 + dexmeditomidine 50mcg. Group B :(n-20) - 30ml 0.33% bupivacaine + dexmeditomidine 75mcg. Group C: (n-20) - 30ml 0.33% bupivacaine + dexmeditomidine 100mcg. Patients were evaluated for sensory & motor block onset and duration, duration of analgesia, sedation score, complications, hemodynamic parameters intra operatively and post operatively. **Results & Conclusion:** Sensory block onset was longer in group A than group B which is longer than group C and motor block onset also longer in group A than group B which is longer than group C. The duration of both sensory and motor block was longest with group C compared with group B which is longer than group A . The mean duration of analgesia was dose dependent with C >B > A. We conclude that dexmeditomidine 100mcg is an optimal dose to provide prolonged post-operative analgesia without significant side effects

KEYWORDS : Supra Clavicular Brachial Plexus Block; Bupivacaine; Dexmeditomidine; Sensory Blockade ; Motor Blockade; Analgesia.

INTRODUCTION:

In peripheral nervous system blockade, a local anesthetics injected into the tissues or in the proximity to peripheral nerves. Initially these techniques were empirical resulting in failure and complications. In the last 3-4 decades the new scientific knowledge about pain and new modalities for conducting peripheral nerve blockade helped to reduce failure rate and complications and also extended its applications.

Peripheral nerve blocks can provide ideal operating conditions, post- operative analgesia and diagnostic, therapeutic role in acute and chronic pain management. The basis for use of peripheral nerve blocks is to interrupt nociceptive impulses coursing in the peripheral nerves.

The advantages of peripheral nerve blocks when compared to the general anesthesia are it causes less interference with physiology of human body, less stress response and avoids using of many drugs and its related complications.

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 lead 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 α2 agonist was used as adjuvant to local anaesthetic which was associated with adverse effects like hypotension and bradycardia. In our study dexmeditomidine, the other drug belongs to α2 agonist is used as an adjuvant to potentiate the action of local anaesthetics. Since dexmeditomidine has α2:α1 selectivity ratio of 1620:1 as compared to 220:1 for clonidine, it decreases unwanted side effects of α1 and much more sedative and analgesic.

This study is designed to compare the effect of three different doses of dexmeditomidine with bupivacaine in brachail plexus block.

AIM AND OBJECTIVES:

Primary Objective:

To compare the effect of three different dose of dexmeditomidine with bupivacaine in supraclavicular brachial plexus block in terms of

- Onset and duration of sensory block
- Onset and duration of motor block. Duration of analgesiaSecondary Objective
- Peri operative hemodynamics
- Complications.

METHODOLOGY:

Study Population:

All Patients undergoing Upper limb orthoipaedic surgery under supra clavicular block in Katuri Medical College & Hospital , chinakondrupadu, Guntur District.

Study Design:

A randomized, double-blinded trial Study setting:
Patients undergoing Upper limb orthoipaedic surgery under supra clavicular block in Katuri Medical College & Hospital , chinakondrupadu ,Guntur District.

Statistical Analysis:

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..

Inclusion Criteria:
Age- 20 -60 yrs
Weight - 50-70 kg
ASA I & II
Written informed consent
Upperlimb orthopedic surgeries

Exclusion criteria:
Refusal for procedure
Significant neurological disease
Psychiatric disorder
Pregnancy and lactation
Patients on anticoagulation
Significant systemic disorder
Known hypersensitivity to study drugs and pt on adrenergic drugs

Sample Size
Sixty patients were studied.

Group allocation
Patients were allocated into three groups,
- Group A(n-20) - 30 ml 0.33% bupivacaine + dexmeditomidine 50mcg
- Group B(n-20) - 30ml 0.33% bupivacaine + dexmeditomidine 75mcg
- Group C (n-20) - 30ml 0.33% bupivacaine + dexmeditomidine 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 anaethesiologist not participating in the study. The intra operative monitoring and post-operative observation was done by the same anesthesiologist who administered the drug and is unaware of the allocation.

Preparation of study drug
Bupivacaine is prepared as 30ml of 0.33% solution by adding 10ml distilled water to 20ml of 0.5% bupivacaine.

Dexmeditomidine is prepared by taking the drug in insulin syringe.

40 units syringe equalent to1ml - 40 units equal to 100μg, 30 units equal to 75μg, and 20 units equal to 50μg.

RESULTS:
Sensory Block onset

Parameter	Sensory Block onset (minutes)		
	Group A	Group B	Group C
Range	10 - 22	10 - 18	5 – 10
p B which was significantly longer than group C. A (16.3±3.31) >B(12.4±2.5) >C(7.35±1); >Mean	16.3	12.4	7.35
S.D.	3.31	2.5	1.5
'p' value between Group A & Group B Group A & Group C Group B & Group C	< 0.0001 Significant < 0.0001 Significant < 0.0001 Significant		

This table 1 shows comparision between sensory block among the three groups.

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)

Motor Block onset

Parameter	Motor Block onset (minutes)		
	Group A	Group B	Group C
Range	15 - 24	12 - 22	8 – 18
Mean	20.4	16.15	12.15
S.D.	2.7	2.89	2.81
'p' value between Group A & Group B Group A & Group C Group B & Group C	< 0.0001 Significant < 0.0001 Significant < 0.0001 Significant		

Table 2 shows the comparison of onset of motor blockade between the three groups. 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

Parameter	Sensory Block Duration (minutes)		
	Group A	Group B	Group C
Range	300 - 560	450 - 740	620 – 800
Mean	432.5	625.5	722.5
S.D.	69.8	72.7	55.1
'p' value between Group A & Group B Group A & Group C Group B & Group C	< 0.0001 Significant < 0.0001 Significant < 0.0001 Significant		

Table- 3 shows the comparison of duration of sensory blockade between the three groups. 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±55.1) >B(625.5±72.7) >A(432.5±69.8)

Motor Block Duration

Parameter	Motor Block Duration (minutes)		
	Group A	Group B	Group C
Range	270 - 580	360 - 720	620 – 800
Mean	426.5	604.5	704.5
S.D.	81.8	98.6	41.4
'p' value between Group A & Group B Group A & Group C Group B & Group C	< 0.0001 Significant < 0.0001 Significant < 0.0001 Significant		

The duration of motor block shown in the above table 4 . 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±41.4) > B (604.5±98.6) > A (426.5±81.8)

Duration of Analgesia

Parameter	Duration of Analgesia (minutes)		
	Group A	Group B	Group C
Range	330 - 610	460 - 780	620 – 820
Mean	480.5	642.0	736.5
S.D.	81.3	76.5	67.1
'p' value between Group A & Group B Group A & Group C Group B & Group C	< 0.0001 Significant < 0.0001 Significant < 0.0001 Significant		

The duration of analgesia between the three groups were 480±81.3,642±76.5 and 736±67.1 minutes respectively. 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±67.1)>B(642±76.5)>A(480±81.3)

DISCUSSION:
Several researches have revealed that the administration of an α2 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 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, bradyardia and respiratory depression. Several animal studies have been investigated the effect of dexmeditomidine as adjunct to local anaesthetics. Brummet &colleagues reported that dexmeditomidine added to ropivacaine in sciatic nerve block provided prolonged analgesia than systemic administration. Another study conducted by Brummett and colleagues discovered that dexmeditomidine 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 dexmeditomidine as adjunct to various local anaesthetics in central neuraxial blockade and peripheralnerve blockade. There are many studies available with various dose of dexmeditomidine as adjuvant to local anaesthetics in supra clavicular brachial plexus block. In our study we designed to 50μg,75μg,100μg of dexmeditomidine to know the optimal compare the three dose dose in supra clavicular brachial plexus block for upper limb orthopedic surgeries.

Demographic characters like age, sex, weight, duration of surgery comparable in all three groups. In our study we observed that 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) .So we conclude that onset of sensory &motor blockade was earlier as the dose increases

The duration of both sensory and motor block was longest with group C (sensory mean 722.5±55.1minutes, motor mean 704±41.4minutes) 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±69.8minutes, motor mean 426.5±81.8).So we conclude that sensory & motor block duration is longer as the dose increases.

The sedation was also dose dependent with group C achieved more sedation than group B who achieved more sedation than groupA. C(4.65±10.4)> B(3.8±1.15) > A(2.95±1.05) 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).

The statistical analysis of intra operative and post-operative hemodynamic variables between the three groups showed no statistical significant hemodynamic fluctuation

CONCLUSION:

Dexmeditomidine, 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.

Dexmeditomidine 100μg is an optimal dose to provide prolonged post-operative analgesia with out any significant side effects.

Ethics approval and consent to participate:
Approval was taken from Katuri Medical College and Hospital's Ethics Committee and written informed patients consents were also taken.

Conflict of interest
None

Source of funding
Self

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