

Original article:

An Observational Comparative Study to Evaluate the Effect of Clonidine and Dexmedetomidine as Adjuvant to Ropivacaine for Supraclavicular Brachial Plexus Block

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ABSTRACT:

Background: Supraclavicular Brachial plexus block is safe, time efficient, cost effective technique that provides satisfactory surgical condition like complete motor & sensory block. Dexmedetomidine a selective alpha-2 agonist, with affinity eight times that of clonidine, also has been shown to prolong the sensory and motor duration when added as an adjuvant to local anaesthetic in peripheral nerve blocks. Thus, it is worthy to evaluate the effect of addition of dexmedetomidine and clonidine to Ropivacaine for supraclavicular brachial plexus block.

Materials & Methods: An Observational Comparative study done on 60 patients in the Department of Anaesthesia, Jawahar Lal Nehru Medical College, Ajmer, Rajasthan. 60 patients ASA grade I & II were randomly divided into 3 group 20 patients in each. Before the procedure, visual analogue scale (VAS) on 0-10 cm was explained to the patient for the assessment of pain where 0 denotes no pain and 10 denotes worst pain. All patients was observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma & ropivacaine toxicity and treated with appropriate measures.

Results: Our study showed that statistical analysis shows no significant difference in average taken for age and weight among three groups. The duration of sensory block, motor block and duration of analgesia found to be longest in group RD and longer in Group RC as compare to Group R. Which is statistically significant (Difference of mean > CD). Bradycardia seen in 1 patient in group RD. Pneumothorax occurred in 1 patient in group RC.

Conclusion: We concluded that dexmedetomidine is better adjuvant than clonidine in supraclavicular brachial plexus block for upper limb surgeries.

Key words: Dexmedetomidine, Ropivacaine, Clonidine, Supraclavicular, Brachial Plexus.

INTRODUCTION

Brachial plexus block is a popular and widely employed regional anaesthesia technique for upper limb surgery which avoids unwanted effect of general anaesthetic drugs, stress of laryngoscopy and tracheal intubation. It is an excellent alternative for hemodynamic compromised & too ill patients. Supraclavicular Brachial plexus block is safe, time efficient, cost effective technique that provides satisfactory surgical condition like complete motor & sensory block¹. Besides all Local anaesthetics bupivacaine² is more frequently used, because of its higher potency and prolonged duration of action. One of the disadvantages is its cardiotoxicity, especially with inadvertent injection into subclavian artery. A long acting local anaesthetic drug, Ropivacaine³ was approved for clinical use in 1996.

Ropivacaine is an amino-amide local anaesthetic (LA) effective for both intraoperative anaesthesia and post-operative analgesia. For peripheral nerve blockade, ropivacaine is comparable to bupivacaine and levobupivacaine⁴. However, the lower lipid solubility of ropivacaine gives away greater sensory and motor differential blockade and reduces the potential for CNS and cardiotoxicity.

In order to avoid catheter complications, adding an adjuvant would be our choice for prolonging the duration of nerve block. The use of peripheral nerve stimulator for brachial plexus block is known to improve success rate. Alpha-2-adrenergic⁵ agonists were chosen for their sedative, analgesic, antihypertensive and antiemetic properties along with decreased requirement of local anaesthetics drugs. Clonidine⁶ a partial alpha-2 agonist has been shown to prolong the duration of anaesthesia and analgesia in peripheral nerve blocks. Dexmedetomidine⁷ a selective alpha-2 agonist, with affinity eight times that of clonidine, also has been shown to prolong the sensory and motor duration when added as an adjuvant to local anaesthetic in peripheral nerve blocks. Thus, it is worthy to evaluate the effect of addition of dexmedetomidine and clonidine to Ropivacaine for supraclavicular brachial plexus block.

MATERIALS & METHODS

An Observational Comparative study done on 60 patients in the Department of Anaesthesia, Jawahar Lal Nehru Medical College, Ajmer, Rajasthan.

Inclusion Criteria

1. ASA Grade I & II,
2. Age 18-60 yrs,

Exclusion Criteria

1. Patients allergic to the drugs used in the study.
2. Neuromuscular disorder.
3. History of hypertension, hepatorenal and metabolic disease.
4. Patient on anticoagulants
5. Pregnancy, Lactational Mother
6. Bleeding disorders

Preanaesthetic Assessment

On the day prior to surgery a thorough clinical examination of the patient was performed including general physical examination and systemic examination.

Anaesthetic Technique

60 patients ASA grade I & II were randomly divided into 3 group 20 patients in each. Before the procedure, visual analogue scale (VAS) on 0-10 cm was explained to the patient for the assessment of pain where 0 denotes no pain and 10 denotes worst pain.

Groups	Drugs & Doses	No. of Patients
I (R)	0.75% Ropivacaine 30 ml + 1ml NS	20
II (RC)	0.75% Ropivacaine 30ml +1 µgm/kg of clonidine	20
III (RD)	0.75% Ropivacaine 30ml + 1 µgm/kg of Dexmedetomidine	20

Anaesthesia work station, equipment for peripheral nerve block and resuscitation were kept ready. After confirmation of fasting status patient was shifted to the operation room and attached to multipara monitor. Baseline heart rate, blood pressure and oxygen saturation were recorded and monitored throughout the procedure. An intravenous line with 18G cannula was secured in the non-operating limb and Ringer's lactate started @ rate 1ml/kg/hr. All the patients were given supraclavicular brachial plexus block using nerve locator (NERVE MAPPER-LOCATOR, NM-20, MFG By INMED EQUIPMENTS PVT-LTD). Following negative aspiration, 31mL of a solution containing Ropivacaine combined either with clonidine or dexmedetomidine or normal saline was injected and 3-min massage was performed to facilitate an even drug distribution.

The duration of analgesia or first request for analgesic defined as the time to attain a Visual Analogue Score (VAS) of 3 or >3 after ropivacaine administration. The VAS was recorded post-operatively every 30min till the score of 3 or >3. The rescue analgesia was given in the form of inj. IV Paracetamol at the visual analogue scale >3 and the time of administration were noted. All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma & ropivacaine toxicity and treated with appropriate measures.

Statistical Analysis

The obtained data was tabulated and analyzed using one-way analysis of variance (ANOVA).

RESULTS

Our study showed that statistical analysis shows no significant difference in average taken for age and weight among three groups (table 1).

The duration of sensory block, motor block and duration of analgesia found to be longest in group RD and longer in Group RC as compare to Group R. Which is statistically significant (Difference of mean > CD) (table 2).

In group RD most patients scored grade 3 and grade 4 sedation while 2 patients attained grade 5 sedation. In group RC most patients scored grade 3 & grade 4 and 1 patient scored grade 5 sedation. None of the patients in group R attained grade 4 sedation (table 3).

Bradycardia seen in 1 patient in group RD. Pneumothorax occurred in 1 patient in group RC (table 4).

Table 1: Distribution of cases according to Age (yrs) & Weight (Kg)

Demographic profile	Group R	Group RC	Group RD
Age (yrs)	35.79±11.23	34.12±12.07	32.23±10.67
Weight (kg)	59.66±10.62	58.16±11.28	57.36±10.56

Table 2: Comparison of duration of sensory & motor block and analgesia in min.

Effect	Group R	Group RC	Group RD
Duration of sensory block	237.53±38.72	320.13±56.11	376.28±52.66
Duration of motor block	205.62±40.23	283.28±55.22	330.88±56.14
Duration of Analgesia	278.23±41.66	356.32±54.25	410.36±49.77

Table 3: Statistical analysis of Sedation score between three groups

Score	Group R	Group RC	Group RD
1	0	0	0
2	8 (40%)	5(25%)	3(15%)
3	12 (60%)	10(50%)	8(40%)
4	0	4(20%)	7(35%)
5	0	1(5%)	2(10%)
6	0	0	0

Table 4: Distribution of cases according to complications

Complications	Group R		Group RC		Group RD		Total	
	No.	%	No.	%	No.	%	No.	%
Nil	20	100.0	19	95%	19	95%	58	96.66%
Bradycardia	0	0%	0	0%	1	5%	1	1.66%
Pneumothorax	0	0%	1	5%	0	0%	1	1.66%
Respiratory depression	0	0%	0	0%	0	0%	0	0%
Nausea /vomiting	0	0%	0	0%	0	0%	0	0%
Agitation	0	0%	0	0%	0	0%	0	0%

DISCUSSION

Analgesia is an essential component of intra and post-operative period. Fear of pain increases anxiety and stress response resulting in increased level of corticosteroids and susceptibility to postoperative infection. One of the important roles of the anaesthesiologist is to provide analgesia during surgery as well as in the post-operative period. The effective management of postoperative pain is to ensure that patient gets relief at the appropriate time without

any complication. The duration of sensory block, motor block and duration of analgesia found to be longest in group RD and longer in Group RC as compared to Group R. Which is statistically significant (Difference of mean > CD) in our study. Bharti N et al⁸ found addition of dexmedetomidine to ropivacaine-lidocaine prolonged the duration of supraclavicular brachial plexus block and improved postoperative analgesia without significant adverse effects.

Patil K.N. et al⁹ found clonidine as an adjuvant to ropivacaine significantly enhances the quality of supraclavicular brachial plexus block by faster onset, prolonged duration of sensory and motor block and improved postoperative analgesia, without associated adverse effects.

Sebastian Don et al¹⁰ found as an adjuvant dexmedetomidine to ropivacaine has faster onset and prolonged duration of sensory block when compared with clonidine. Das A et al¹¹ observed that addition of 100 mcg dexmedetomidine to ropivacaine 0.50% solution prolongs the duration of sensory blockade, but has no appreciable effect on the onset time of sensory block. Jaiswal R et al¹² found addition of clonidine (150 microgram) is of no benefit in the onset and duration of block and suggests that pure ropivacaine 0.5% is sufficient for long lasting axillary block by single injection with peripheral nerve stimulator for performing elbow and below elbow surgery. Selective α_2 -adrenoceptor agonist like clonidine or dexmedetomidine when added to ropivacaine in different peripheral nerve blocks potentiates the sensorimotor blockade. But the exact mechanism is not clear.

Probably peripherally, α_2 -agonists produce analgesia by reducing release of norepinephrine and causing α_2 -receptor-independent inhibitory effects on Nerve fibre action potentials.²⁵ Experiments on dexmedetomidine as an adjuvant for nerve blocks have shown that the duration of analgesia is prolonged by block of the hyperpolarization-activated cation current (I_h current). The I_h current is important to bring a peripheral nerve back to the resting potential. Blocking the I_h current will result in prolonged hyperpolarization of the nerve, which seems to be more distinct in the unmyelinated C fibres (pain) than in A α fibres (motor). Therefore, blocking the I_h current may have a more pronounced effect on pain than on motor response other indirect actions of dexmedetomidine include central analgesia, vasodilatation and anti-inflammation properties.¹³

Centrally, α_2 -agonists cause analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of α_2 -adrenoceptors in locus coeruleus¹⁴. So, the action of Dexmedetomidine and clonidine would then more likely be via a synergistic mechanism of action in combination with the local anaesthetic resulting in the prolonged effect.¹⁵ Singh AP et al¹⁶ found that dexmedetomidine, when added to levobupivacaine significantly prolonged duration of analgesia that obviates the need for any additional analgesics. The added advantage of conscious sedation, hemodynamic stability and minimal side effects makes it a potential adjuvant for nerve blocks.

Casati et al¹⁷ found adding 1 μ g/kg clonidine to 20 ml of ropivacaine 0.75% for axillary brachial plexus anesthesia provided a 3 h delay in first analgesic request postoperatively, without clinically relevant effects on the degree of sedation and cardiovascular homeostasis. In our study only 1 patient had bradycardia in RD group, which was treated with appropriate dose of atropine. That was 3.33% in the group and 1.12% of total study patients. Pneumothorax developed in 1 patient of group R, which is 3.33% in the group and 1.12% of total study patients. No other complications like nausea, vomiting, neurotoxicity, cardio toxicity were found in either group.

CONCLUSION

We concluded that dexmedetomidine is better adjuvant than clonidine in supraclavicular brachial plexus block for upper limb surgeries.

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