

Comparison of Dexmedetomidine and Clonidine as an Adjuvant to Bupivacaine in Supraclavicular Brachial Plexus Block for Upper Limb Surgeries

Devulapalli Janardhana Pradeep¹, Subhaprada Satapathy², Rasulata Swain³, Ayesha Pattnaik⁴

Abstract: *Background:* Various additives are added with local anaesthetics to lengthen the quality of block in regional anaesthesia. compared clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block to compare the onset and duration of sensory and motor block. *Aim:* To compare the effectiveness of clonidine and dexmedetomidine as adjuvant in brachial plexus block by supraclavicular approach for lengthening of sensory and motor blockade and duration of analgesia. *Materials and methods:* Sixty ASA Grades I and II patients posted for orthopaedic surgeries of the upper limb under supraclavicular brachial plexus block were divided into two groups in a randomized, double-blind manner. Patients were divided randomly into two groups. In Group BC (n = 30), 39 ml of 0.25% bupivacaine plus 1 ml (1 µg/kg) clonidine and in Group BD (n = 30), 39 ml of 0.25% bupivacaine plus 1 ml (1 µg/kg) dexmedetomidine are given. The onset and duration of sensory and motor block and duration of analgesia were studied in both the group. *Discussion:* In our study, we compared the addition of clonidine (1 µg/kg) and dexmedetomidine (1 µg/kg) to bupivacaine in SCBP block. The study revealed that onset time for both sensory and motor blocks after the supraclavicular brachial plexus block using either clonidine or dexmedetomidine with bupivacaine were similar. But, dexmedetomidine gave longer duration of both motor and sensory blocks and lengthened duration of analgesia. dexmedetomidine group had better quality of anaesthesia. *Conclusion:* our study demonstrated that addition of dexmedetomidine to bupivacaine in supraclavicular brachial plexus block prolonged the duration of analgesia and improved the quality of anaesthesia as compared to clonidine with better hemodynamic stability and less side effects, that makes dexmedetomidine a better choice as an adjuvant to bupivacaine for supraclavicular brachial plexus block.

Keywords: Clonidine, dexmedetomidine, bupivacaine, supraclavicular brachial plexus block

1. Introduction

Supraclavicular brachial plexus block is a regional Anaesthetic technique used to give anaesthesia and analgesia for upper limb surgeries.

α - 2 adrenoreceptor agonists have been the focus of interest for their sedative, analgesic, and perioperative sympatholytic and cardiovascular stabilizing effects with reduced Anaesthetic requirements. Clonidine, an imidazoline, α - 2 adrenoreceptor agonist, has been extensively studied as an adjuvant to local Anaesthetic in peripheral nerve blocks.

The Anaesthetic and analgesic requirements get lessened to a great extent by the use of these two adjuvants because of their analgesic properties and augmentation of local Anaesthetic effects.

The present study was done to compare the efficacy of clonidine and dexmedetomidine as an adjunct with bupivacaine in supraclavicular brachial plexus block in upper limb surgery for the onset and duration of sensory and motor block and duration of analgesia.

2. Materials and methods

The present clinical observational, analytical study entitled: COMPARISON OF dexmedetomidine and clonidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block for upper limb SURGERIES 60 patients posted for elective surgeries selected randomly

The study was conducted between June 2021 - June 2022 at Alluri Sitarama Raju Academy of Medical Sciences, Eluru,

after getting approved by the institutional ethical committee. Individual informed consent was taken from all the patients selected for the study from Orthopedic Surgery departments posted for elective surgeries.

Inclusion criteria

Patients aged 15– 55 years of either sex

ASA grade I and II

Patients posted for Upper limb orthopedic surgeries

Exclusion criteria

ASA grade – III & IV

Patients with severe anaemia, hypovolemia, septicemia, shock

Known hypersensitivity reaction to clonidine or dexmedetomidine.

Bleeding disorders or on anticoagulant therapy

Local infection at the site of puncture.

Unwilling patients

Equipment's for the procedure

A portable tray covered with sterile towel containing Sterile syringes containing one 20ml and one 10ml. Hypodermic needles of 5cms length, 22G. Bowls containing povidone iodine and spirit. Sponge holding forceps. Towel and towel clips. Sterile gauze pieces.

3. Procedure

- After getting ethical committee approval, informed consent was taken from the patients. Intravenous access was done, anaesthesia machine checked, resuscitative

equipment and drugs were kept ready. Patients were allocated into the following two groups.

- Group BD – received 35cc of 0.25% bupivacaine with dexmedetomidine 1µg/kg.
- Group BC – received 35cc of 0.25% bupivacaine with clonidine 1µg/kg.
- Patient was kept in supine position, with their arms by the side and the head is turned slightly to the opposite side.
- The interscalene groove and the midpoint of the clavicle were identified.
- After strict aseptic precautions of the area, just above the midpoint of the clavicle, the subclavian artery pulsation was felt and 1.5 to 2cms posterosuperior to it a skin wheel was raised with local Anaesthetic.
- A 22G, 5cms needle mounted on a 20ml syringe loaded with the drug was inserted at the same point in a backward, inward and downward direction. Either paresthesia was elicited or the first rib was encountered while injection.
- If the first rib was encountered the needle was gently walked over the first rib until paresthesia was elicited in the arm or hand, after which the drug was injected following a negative aspiration of blood.
- All the patients were monitored for anaesthesia and analgesia for 24hrs post - operatively.
- Sensory block was evaluated by eliciting temperature sensation using spirit - soaked cotton over the distribution of the ulnar and median nerve, whereas a motor block was assessed by asking the patient to flex the forearm against gravity.

4. Results

50 ASA I & II of both sex aged between 15 - 55yrs, posted for upper limb surgeries under supraclavicular brachial plexus block were selected for the study.

The minimum age of the patient was 15yrs and the max age was 55yrs. The mean age of the patient in group BC was 36.8±12.26Bwas34.88±9

The mean time for onset of sensory block was in group BC was 11.14+/- 1.13 and in group BD was 8.8+/- 0.91 min. the statistical analysis by student's unpaired "t" test showed that the time of onset of sensory block in group BD was significantly faster than group BC [P< 0.001]

Table 1: Onset of Sensory block (in min)

Group	Mean±SD	T value	P value	significance
BC	11.14±1.13	8.05	<0.001	HS
BD	8.8±0.91			

The mean time for onset of motor block in group BC was 13.6 +/- 1.11 and in group BD was 11.36+/- 0.952. the statistical analysis by student's unpaired "t" test showed that the time of onset of motor block in group BD was significantly faster than group BC (p < 0.001)

Table 2: Onset of Motor block (in min)

Group	Mean±SD	T value	P value	Significance
BC	13.6±1.11	7.65	<0.001	HS
BD	11.36±0.952			

Duration of sensory block was observed for 24hrs. The time was noted when the patient asked for rescue analgesia. The mean duration of sensory block in group BC was 7.06+/- 0.664 and in group BD was 9.3+/- 0.667hrs. The statistical analysis by student's unpaired "t" test showed the time of duration of sensory block in group BD was significantly faster than group BC (p<0.001)

Table 3: Duration of Sensory block (in hours)

Group	Mean±SD	T value	P value	significance
BC	7.06±0.664	11.9	<0.001	HS
BD	9.3±0.667			

Mean duration of motor block in group BC was 6.66+/- 0.657 and in group BD was 8.5 +/- 0.692hrs. the statistical analysis by student's "t" test showed that the duration of motor block in group BD was significantly longer than group BC (p<0.001)

Table 4: Duration of motor block (in hours)

Group	Mean±SD	T value	P value	significance
BC	6.66±0.657	9.64	<0.001	HS
BD	8.5±0.692			

In group BC 20% of patients required one rescue analgesic dose and 80% required 2 analgesic doses, whereas in group BD 56% required one analgesic dose and only 44% required 2 analgesic doses. The difference in no of rescue analgesics required by both the group were statistically significant by Chi - square test (p, 0.018)

Sedation score was evaluated using Ramsay sedation score:

- Anxious and alert
- Conscious and oriented.
- Sedated, responding to verbal commands.
- Responding only to mild physical stimulus.
- Responding to moderate & severe physical stimulus.

In group BC, sedation score corresponding to score 2 was observed in 84% of patients and sedation score of 3 in 16% of patients, whereas in group BD, sedation score corresponding to 2 was observed in 20% of patients and sedation score of 3 in 80% of patients. The difference in sedation score between the two groups was found to be statistically significant by student's unpaired 't' test. (p<0.001).

Side effects

Patients were observed for side effects such as hypotension and bradycardia. in both the group, there was no incidence of hypotension and bradycardia. only two patients experienced minimal pneumothorax, patients was followed by taking chest X - ray the pneumothorax gradually resolved 4 patients have an inadequate block and were excluded from the study.

5. Discussion

Brachial plexus provides post - op analgesia only for a short duration even when we use longer acting LA agents like bupivacaine. Hence, various adjuvants like opioids, midazolam, neostigmine, etc, have been evaluated to prolong the duration of analgesia

The newer drugs clonidine and dexmedetomidine were found to produce anti - nociception when used intrathecally and epidurally.

Hence these drugs were used as an attempt to assess the efficacy of dexmedetomidine over clonidine as an adjuvant to bupivacaine in brachial plexus block. They were compared in terms of onset time, duration of analgesia and sedation. Hemodynamic variables and no of rescue analgesia in first 24hrs were also studied

A total of 50 patients in the age group of 15 - 55yrs were included in the study, 25 in each group. Out of which the mean age of group BC (receiving bupivacaine with clonidine) was 36.8 ± 12.26 yrs and the mean age of group BD (receiving bupivacaine with dexmedetomidine) was 34.88 ± 9.03 yrs. hence both the groups were comparable in regard to age.

In our study, it was found that the onset of sensory block and motor block were significantly faster in patients who received a combination of bupivacaine and dexmedetomidine than the combination of bupivacaine and clonidine. Onset of sensory block (group BC 11.14 ± 1.13 min: group BD - 8.8 ± 0.192 min). Onset of motor block (group BC - 13.6 ± 1.22 min: group BD - 11.36 ± 0.9 min).

Clonidine was used previously for its antihypertensive properties. The central actions are mediated through α_2 adrenoceptors, which are situated at locus coeruleus and the dorsal horn of spinal cord. But, specific peripheral effects of clonidine appear to be less obvious because these adrenoceptors are not present on the axon of the normal peripheral nerve. Four mechanisms have been proposed for the action of clonidine in peripheral nerve blocks. They include centrally mediated analgesia, vasoconstrictive effects via $\alpha_2 \beta$ adrenoceptor receptors, direct action on peripheral nerve and attenuation of inflammatory response. The direct action of clonidine on the nerve can be explained on the basis of a study conducted by Dalle et al. They proposed that clonidine, by enhancing activity - dependent hyperpolarization generated by the Na/K pump, increases the threshold for initiating the action potential causing slowing or blockage of conduction. Popping et al. in their meta - analysis of randomized controlled study showed that the beneficial effect of clonidine on the duration of analgesia was observed with all tested local Anaesthetic.

6. Conclusion

To conclude, we would like to state that dexmedetomidine lengthen the duration of sensory and motor block as compared with clonidine when it is used as an adjuvant to Bupivacaine in peripheral nerve block.

It is observed that addition of dexmedetomidine to bupivacaine compared to clonidine has

- 1) Quick onset of sensory block
- 2) Fast onset of motor block
- 3) Lengthen the duration of sensory block
- 4) Lengthen duration of motor block
- 5) Fewer no. of rescue analgesics in post - operative 24hrs

- 6) Pleasant sedation where the patient can be arousable at any time
- 7) No remarkable difference in hemodynamic changes.

References

- [1] Eledjam JJ, Deschodt J, Viel EJ, Lubrano JF, Chavel P, d'Athis F, et al. Brachial plexus block with bupivacaine: Effects of added alpha - adrenergicagonists: Comparison between clonidine and epinephrine. *Can J Anaesth.*1991; 38: 870-5.
- [2] Gaumann D, Forster A, Griessen M, Habre W, Poinot O, Della Santa D. Comparison between clonidine and epinephrine admixture to lidocaine in brachial plexus block. *Anesth Analg.*1992; 75: 69-74.
- [3] Singelyn FJ, Gouverneur JM, Robert A. A minimum dose of clonidine added to mepivacaine prolongs the duration of anesthesia and analgesia after axillary brachial plexus block. *Anesth Analg.*1996; 83: 1046-50
- [4] El Saied AH, Steyn MP, Ansermino JM. Clonidine prolongs the effect of ropivacaine for axillary brachial plexus blockade. *Can J Anaesth.*2000; 47: 962-7.
- [5] Iskandar H, Benard A, Ruel - Raymond J, Cochard G, Manaud B. The analgesic effect of interscalene block using clonidine as an analgesic for shoulder arthroscopy. *Anesth Analg.*2003; 96: 260-2
- [6] Singh S, Aggarwal A. A randomized controlled double - blinded prospective study of the efficacy of clonidine added to bupivacaine as compared with bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries. *Indian J Anaesth.*2010; 54: 552-7.
- [7] Yoshitomi T, Kohjitani A, Maeda S, Higuchi H, Shimada M, Miyawaki T. Dexmedetomidine enhances the local anesthetic action of lidocaine via an alpha - 2A adrenoceptor. *Anesth Analg.*2008; 107: 96-101.
- [8] Brummett CM, Norat MA, Palmisano JM, Lydic R. Perineural administration of dexmedetomidine in combination with bupivacaine enhances sensory and motor blockade in sciatic nerve block without inducing neurotoxicity in rat. *Anaesthesiology.*2008; 109: 502-11.
- [9] Brummett CM, Amodeo FS, Janda AM, Padda AK, Lydic R. Perineural dexmedetomidine provides an increased duration of analgesia to a thermal stimulus when compared with a systemic control in a rat sciatic nerve block. *Reg Anesth Pain Med.*2010; 35: 427-31.
- [10] Brummett CM, Hong EK, Janda AM, Amodeo FS, Lydic R. Perineural dexmedetomidine added to ropivacaine for sciatic nerve block in rats prolongs the duration of analgesia by blocking the hyperpolarization - activated cation current. *Anaesthesiology.*2011; 115: 836-43
- [11] Abosedira MA. Adding clonidine or dexmedetomidine to lidocaine during Bier's block: A comparative study. *J Med Sci.*2008; 8: 660-4
- [12] Brummett CM, Hong EK, Janda AM, Amodeo FS, Lydic R. Perineural dexmedetomidine added to ropivacaine for sciatic nerve block in rats prolongs the duration of analgesia by blocking the hyperpolarization - activated cation current. *Anesthesiology.* 2011; 115: 836 - 43.

- [13] Kosugi T, Mizuta K, Fujita T, Nakashima M, Kumamoto E. High concentrations of dexmedetomidine inhibit compound action potential in frog sciatic nerve without α_2 adrenoceptor activation. *Br J Pharmacol* 2010; 160: 1662 - 76.
- [14] Kanazi GE, Aouad MT, JAbbour - Khoury SL, Al Jazzar MD, Alameddine MM, Al - Yaman R, et al. Effects of low doseDexmedetomidine or clonidine on characteristics of spinal block. *Acta Anaesthesiol Scand* 2006; 50: 222 - 7.
- [15] Memis D, Turan A, Karamanlioglu B, Pamukçu Z, Kurt I. Addingdexmedetomi dine to lignocaine for IVRA. *Anesth Analg* 2004; 98: 835 - 40.
- [16] Esmoğlu A, Yegenoğlu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anaesth Analg* 2010; 111: 1548 - 51.