

Dexmedetomidine as an Adjuvant to Bupivacaine in Brachial Plexus Block by Supraclavicular Approach

Shubha Padakannaya¹, Sa Ribeiro Karl Nicholas²

¹Resident, Department of Anaesthesiology, Father Muller Medical College, Mangalore

²Assistant Professor, Department of Anaesthesiology, Father Muller Medical College, Mangalore

Abstract: ***Background and Aims:** The present study aimed at determining the efficacy of dexmedetomidine as an adjuvant to bupivacaine with respect to speed of onset of sensory and motor blockade. **Methodology:** 60 patients aged between 18-60 years were randomized and divided into two equal groups. Group I received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline(15ml) + normal saline(0.5ml) while Group II received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline (15ml) + Dexmedetomidine(1micro gram /kg). Onset of action of Sensory blockade and motor blockade were noted as the time interval between administration of local anesthetic solution to loss of pin prick sensation and the time interval between administration of local anesthetic solution to loss of movements respectively. **Results:** The groups were comparable with respect to their age, sex & weight because there was no statistical significant difference among the groups ($p > 0.05$). The mean onset time of sensory blockade was faster in group II (9.9 ± 2.34) compared to that in group I (17.7 ± 2.35). This difference was statistically highly significant ($P < 0.001$). The mean onset time of motor blockade was faster in group II (14.8 ± 2.48) compared to that in group I (21.4 ± 3.22). This difference was statistically highly significant ($P < 0.001$). **Conclusion:** From this study, we would like to suggest that dexmedetomidine can be safely used with local anesthetics in peripheral nerve blocks.*

Keywords: dexmedetomidine, bupivacaine, ultrasound, brachial block

1. Introduction

Peripheral blockade remains a well-accepted component of comprehensive anesthetic care. Its role has expanded from the operating suite into the arena of postoperative and chronic pain management. Skillful application of peripheral neural blockade broadens the anesthesiologist's range of options in providing optimal anesthetic care.¹

Regional anesthesia avoids the unwanted effect of anesthetic drugs used during general anesthesia and the stress of laryngoscopy and tracheal intubation. Patients can also enjoy a post operative period free from nausea, vomiting, cognitive dysfunction and immediate post operative pain.

Brachial plexus blockade is a time tested, popular and widely employed regional nerve block of upper extremity. Among the various approaches of brachial plexus block, supraclavicular approach is considered easiest and most effective. The first supraclavicular brachial plexus block was performed by Kulenkampff in 1912.²

The classical approach using paraesthesia technique is a blind technique & may be associated with higher failure rate and injury to the nerves and surrounding structures. The ultrasonographic visualization of the nerves to be blocked is a relatively new technique that holds promise for the future³. This allows direct visualization of peripheral nerves, the block needle, and local anesthetic distribution. This imaging modality has proven highly useful to guide targeted drug injections and catheter placement.⁴

Various adjuvants like neostigmine, midazolam, opioids, hyaluronidase, α_2 adrenergic receptor agonists⁵⁻⁸, dexamethasone¹⁹ to name a few have been used in order to

modify the block in terms of rapidity of onset of action, good quality, prolonged duration & post-operative analgesia. Dexmedetomidine, a potent α_2 adrenoceptor agonist, is approximately eight-times more selective towards the α_2 adrenoceptor than clonidine. It has been used as an adjuvant during regional and local anaesthesia⁸. Several studies have shown efficacy of adding dexmedetomidine to local anaesthetic procedures, such as subarachnoid, epidural, and caudal injections. However, there remains limited knowledge on its analgesic efficacy and duration in peripheral nerve and nerve plexus blockade.

Here is an attempt to study the efficacy of dexmedetomidine as an adjuvant to local anaesthetics for supraclavicular brachial plexus blockade. The primary endpoints are the onset of sensory and motor block.

2. Methodology

This study was conducted at the father mullers medical college hospital over a period of 6 months between December 2016 and May 2017. This study was done after Ethical Committee approval and written informed consent was obtained from all patients included in the study. 60 patients aged between 18 and 60 years, belonging to ASA I or ASA II, and undergoing elective upper limb surgery were included in the study. They were randomized & divided into two equal groups in a double blind fashion by sealed envelope technique.

Group I: Patients received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline (15ml) + normal saline(0.5ml).

Group II: Patients received 0.5% bupivacaine (15ml)+ 2% lignocaine with adrenaline (15ml) + Dexmedetomidine

(1micro gram /kg). The outcome was measured in terms of duration of onset of motor and sensory blockade. The Onset of action of Sensory blockade is defined as the time interval between administration of local anesthetic solution to loss of pin prick sensation. The Onset of action of Motor blockade is defined as the time interval between administration of local anesthetic solution to loss of movements.

All the patients underwent thorough pre anesthetic evaluation on the day prior to surgery. All systems were examined including airway and the surface anatomy where the block was going to be given, and the procedure to be carried out was explained. Patients were reassured to alleviate their anxieties. All the patients were kept nil per oral as per the fasting guidelines. Written informed consent taken.

Intravenous access was obtained with 20G intravenous cannula on the contralateral upper limb under aseptic techniques & intravenous fluids were started.

Premedication: Midazolam 0.05mg/kg and Fentanyl 0.5µg/kg intravenously 15 minutes before the procedure.

Monitors: Pulse oximetry, Non-invasive blood pressure monitor on the opposite upper limb, respiratory rate, electrocardiography. Basal readings were noted.

Position: Patient was made to lie supine with head turned opposite to side of intended block and arm adducted & pulled down gently. A small pillow or folded sheet was placed below the shoulder to make the field more prominent.

Landmarks: A point 1cm above the midpoint of clavicle and pulsations of the subclavian artery.

Parts were prepared with povidone iodine solution. Anatomical landmarks were identified & local infiltration of 1ml of 2% lignocaine was given at the puncture site.

This procedure was done by using sonosite ultrasound machine with 13-6 MHz transducer by in-plane approach using 22G, 100mm needle. Ultrasound machine & probe were prepared for the procedure under all aseptic precautions using plastic wraps and betadine. Block was performed after real time visualization of the vessels, nerve & bone. In plane approach using 10ml syringe containing local anesthetic was injected & the drug distribution was noted.

During the procedure & thereafter, the patient was observed vigilantly for any complications of the block & for the toxicity of the drugs injected.

Following precautions were taken to prevent deleterious effects:

- 1) Repeated aspiration before injection to prevent intravascular injections.
- 2) Injection would be stopped if early signs of toxicity appeared.

The onset of action of sensory and motor blockade was noted. The loss of pinprick sensation was checked every 3

minutes till the onset of loss of sensation. The motor blockade was assessed every 3 minutes till the loss of movement.

Sensory blockade was assessed by pin-prick sensation by a short bevelled 25G needle:

- 0: No pain
- + : Mild pain- Grimace
- ++ : Moderate pain- Withdraws
- +++ : Severe pain- Screams

Motor blockade was graded according to movement of upper limb by the patient as:

- 1) Flicker of contraction
- 2) Movement with gravity eliminated
- 3) Movement against gravity
- 4) Movement against gravity & some resistance
- 5) Normal power

Possible side effects of brachial plexus block : Incidence of nausea, vomiting, Horner's syndrome, phrenic nerve palsy, pneumothorax, respiratory depression & signs & symptoms of local anesthetic toxicity, if any were looked for & noted. Inadequate sensory & motor blockade beyond 30mins following the infiltration was considered as unsuccessful block. These cases were excluded from the study.

3. Statistical Analysis

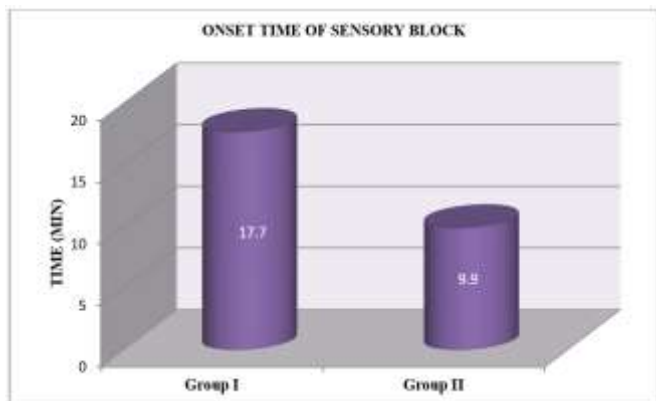
All recorded data were entered using MS Excel software and analysed using SPSS 20 version software for determining the statistical significance. Results were expressed as mean±standard deviation. Proportions were compared using Chi-square test. The student 't' test was used to determine whether there was a statistical difference between the study groups. "P" value of >0.05 was considered not to be statistically significant, <0.05 was considered to be statistically significant, a value of <0.01 was highly statistically significant & a "P" value of <0.001 was considered as extremely statistically significant.

		Group I	Group II	P Value
Age		33.7±13.57	31.5±13.76	0.53
Sex	Males	24	25	0.73
	Females	6	5	
Weight		65±8.1	64±7.16	0.33

The groups were comparable with respect to their age, sex & weight because there was no statistical significant difference among the groups (p > 0.05).

1. Onset Time of Sensory Block

	Group I	Group II	t Value	P Value
Mean	17.7	9.9	12.88	<0.001
SD	2.35	2.34		

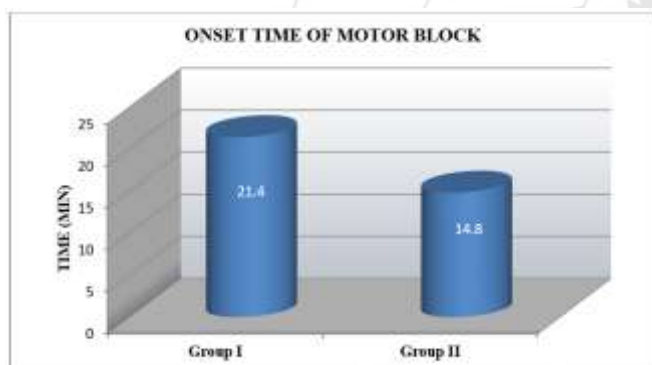


The mean onset time of sensory blockade was faster in group II (9.9 ± 2.34) compared to that in group I (17.7 ± 2.35). This difference was statistically highly significant ($P < 0.001$).

2. Onset Time of Motor Block

	Group I	Group II	t Value	P Value
Mean	21.4	14.8	8.89	<0.001
SD	3.22	2.48		

The mean onset time of motor blockade was faster in group II (14.8 ± 2.48) compared to that in group I (21.4 ± 3.22). This difference was statistically highly significant ($P < 0.001$).



4. Discussion

Peripheral nerve blocks are cost effective anesthetic techniques used to provide good quality anesthesia and analgesia while avoiding airway instrumentation and hemodynamic consequences of general anesthesia. Patient satisfaction, a growing demand for cost effective anesthesia and a favorable postoperative recovery profile have resulted in increased popularity for regional techniques. Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries. Various approaches like supraclavicular, interscalene, infraclavicular and axillary have been used for blocking the brachial plexus. Supraclavicular approach to brachial plexus block is associated with rapid onset and reliable anesthesia⁹⁻¹⁰. It is the most effective block for all the portions of the upper extremity & is carried out at the 'division' level of the brachial plexus; with high volume the 'trunk' level of the plexus may also be blocked.

Advantages of brachial plexus block when compared to general anaesthesia are:

1. Early discharge for outpatients.
2. Smooth transition to pain control.
3. Increased blood flow to the extremity.
4. Less nausea & vomiting.
5. Less drowsiness.
6. No need for tracheal intubation.

The alleviation of the suffering is of primary concern. Any method of postoperative pain relief must meet three basic criteria; it should be effective, safe & feasible. Currently available local anaesthetics can provide analgesia for limited period of time when used as single injection. To extend the analgesic period beyond the operating rooms, various methods have been tried with the aim of prolonging the local anaesthetic action, like continuous infusion of local anaesthetics via indwelling catheters or use of various adjuvants.

Dexmedetomidine is an α_2 selective agonist. It acts in a manner similar to clonidine, but the specificity of Dexmedetomidine for the alpha-2 receptor is 8 times that of clonidine¹²⁻¹⁵. The efficacy of peripheral perineural dexmedetomidine added to bupivacaine & ropivacaine for sciatic nerve blocks in rats has been established.¹⁶⁻¹⁷ The increase in duration of analgesia is dose dependent & the effect is peripheral (i.e., not caused by centrally mediated or systemic analgesia).

In this study, dexmedetomidine was used as an adjuvant to local anaesthetic. The assessment of onset of block was carried out by the principal investigator who was blinded to the drugs administered during the block.

In our study, the mean onset time of sensory & motor blockade was faster in dexmedetomidine group. There was no statistically significant difference among the demographic data between the study groups.

Bradycardia & hypotension seen in dexmedetomidine group were clinically insignificant. There were no other side effects like nausea, vomiting or respiratory depression, making dexmedetomidine a better adjuvant for peripheral nerve blocks.

From this study, we would like to suggest that dexmedetomidine can be safely used with local anaesthetics in peripheral nerve blocks; however further studies to determine the safety, significant side effects as well as ideal dose in peripheral nerve blocks are warranted.

5. Conclusion

We conclude that dexmedetomidine added to bupivacaine-lignocaine with adrenaline in supraclavicular brachial plexus block is extremely effective in reducing the time of onset of both sensory & motor blockade without significant side effects.

References

- [1] Denise J. Wedel and Terese T. Horlocker, Nerve blocks, Miller's Anesthesia, Ronald.D. Miller 7th edition 2010; Churchill living stone Elsevier; 1639-1674
- [2] J. Alfred Lee, R.S Atkinson, G B Rushman, A synopsis of anesthesia, 10th edition 1987; 618
- [3] H.H. Meherkants, Tutorials in peripheral regional anesthesia, 3rd edition 2005; 6
- [4] Andrew T. Gray, Ultrasound Guidance for Regional Anesthesia, Miller's Anesthesia, Ronald.D. Miller 7th edition 2010; Churchill living stone Elsevier; 1675-1686
- [5] Bazin JE, Massoni C, Bruelle P, Fenies V, Groslier D, Schoeffler P. The addition of local anesthetics in brachial plexus block: The comparative effects of morphine, buprenorphine & sufentanil. *Anaesthesia* 1997;52:858-62
- [6] Bone HG, van Aken H, Brooke M, Burkle H. Enhancement of axillary brachial plexus block anaesthesia by coadministration of neostigmine. *Reg Anesth Pain Med* 1992;24:405-10.
- [7] Keeler JF, Simpson KH, Ellis FR, Kay SP. Effect of addition of hyaluronidase to bupivacaine during axillary brachial plexus block. *Br J Anaesth* 1992;68:68-71
- [8] Sarita S Swami, Varshali M Keniya, Sushma DLadi, Ruchika Rao: Comparison of dexmedetomidine and clonidine (α_2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. *Indian Journal of Anaesthesia*: 2012 May-Jun; 56(3):243-249.
- [9] Winnie AP. Historical consideration. Chapters 2 and 4. *Plexus Anaesthesia*. New York: Churchill Livingstone 1984;1:43-116,192-202.
- [10] Livingstone EM, Wertheim H. Brachial plexus block: Its clinical application. *Anaesth Analg* June, 1927.
- [11] Vincent WS Chan. Ultrasound imaging for regional anesthesia. 2nd edition. Chapter 1; 2007:1-2
- [12] Aliye Esmaoglu, Fusun Yegenoglu, MD, Aynur Akin, and Cemil Yildirim Turk: Dexmedetomidine Added to Levobupivacaine Prolongs Axillary Brachial Plexus Block. *Anesth Analg*-2010, Dec; 111(6):1548-51.
- [13] Obayah, Gihan M; Refaie, Amira; Aboushanab, Ossama; Ibraheem, Neamat; Abdelazees, Mossad: Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia after cleft palate repair. *European Journal of Anaesthesiology*: March 2010; 27(3):280-284.
- [14] Rachana Gandhi, Alka Shah, Ila Patel: Use of Dexmedetomidine along with Bupivacaine for brachial plexus block. *National journal of medical research* Jan-March 2012; 2(1):67-69.
- [15] Amany S. Ammar, Khaled M. Mahmoud: Ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomised controlled trial. *Saudi Journal of Anaesthesia*: April-june 2012; 6(2):109-14.
- [16] Abdallah FW & Brull R. facilitatory effects of perineural dexmedetomidine on neuraxial & peripheral nerve block: a systematic review & meta-analysis. *Br J Anaesth* 2013; 110(6):915-25.
- [17] Saadawy, Boker A, Elshahawy MA, Almazrooa A, Melibar S, Abdellatif AA. Effect of dexmedetomidine, on the characteristics of bupivacaine in a caudal block in paediatrics. *Acta Anaesthesiol Scand*. 2009;53:251-256
- [18] 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 Anaesthesia* 2010; 54:552-7.
- [19] Karl S Ribeiro, A Ollapally, J Misquith. Dexamethasone as an adjuvant to bupivacaine in supraclavicular brachial plexus block in paediatrics for post operative analgesia. *J Clin Diagn Res* 2016; UC01-UC04.