

COMPARISON OF DEXMEDETOMIDINE AND CLONIDINE AS AN ADJUVANT TO BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A RANDOMISED DOUBLE-BLIND PROSPECTIVE STUDY

Fayaz Ahmad Munshi¹, Fahmeeda Bano², Aftab Ahmad Khan³, Basharat Saleem⁴, Mushtaq Ahmad Rather⁵

HOW TO CITE THIS ARTICLE:

Fayaz Ahmad Munshi, Fahmeeda Bano, Aftab Ahmad Khan, Basharat Saleem, Mushtaq Ahmad Rather. "Comparison of Dexmedetomidine and Clonidine as an Adjuvant to Bupivacaine in Supraclavicular Brachial Plexus Block: A Randomised Double-Blind Prospective Study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 42, May 25; Page: 7263-7268, DOI: 10.14260/jemds/2015/1055

ABSTRACT: BACKGROUND: Dexmedetomidine, a potent α_2 -adrenoceptor agonist, is approximately eight-times more selective towards the α_2 -adrenoceptor than clonidine. **AIM:** Comparison of clonidine and dexmedetomidine as an adjuvant to local anaesthetic in supraclavicular brachial block. **MATERIALS AND METHODS:** Sixty patients of age group 18-60 years, scheduled for various elective orthopaedic surgeries on forearm and around the elbow under supraclavicular brachial block were divided into two equal groups in a randomized, double-blinded fashion. In group C (n = 30), 30 ml of 0.25% bupivacaine+clonidine 1 μ g/kg; and in group D (n=30), 30 ml of 0.25% bupivacaine+dexmedetomidine 1 μ g/kg were given. Onset of motor and sensory block, duration of sensory and motor block, quality of block, and duration of postoperative analgesia were recorded. **RESULTS:** Demographic data and surgical characteristics were similar in both groups. The sensory and motor block onset time was same in both groups (P >0.05). Sensory and motor blockade durations were longer in group D than in group C (P < 0.001). Duration of postoperative analgesia was longer in group D than in group C (P < 0.001). The 24 h Numerical Rating Pain score was more in Group D as compared to Group C. The quality of anaesthesia was excellent in group D as compared to group C (P <0.001). The mean pulse rate and mean blood pressure levels at different time intervals were statistically insignificant between the groups (P > 0.05). **CONCLUSIONS:** Dexmedetomidine added to bupivacaine for supraclavicular brachial plexus block prolongs the duration of the motor and sensory block and the duration of postoperative analgesia significantly as compared to clonidine.

KEYWORDS: Dexmedetomidine, clonidine, bupivacaine, supraclavicular brachial plexus block.

INTRODUCTION: The use of clonidine, a partial α_2 adrenoreceptor agonist, in peripheral nerve blocks, has been reported to be safe and beneficial and prolongs the duration of anaesthesia and analgesia.^[1,2] Dexmedetomidine is an α_2 receptor agonist, and its α_2/α_1 selectivity is eight times more than clonidine. It has been reported to improve the quality of intrathecal and epidural anaesthesia.^[3,4] However, its use in brachial plexus blocks has been described in very few studies. In this study, we investigated the effect of adding dexmedetomidine to bupivacaine and compared it with clonidine for brachial plexus blocks. Our primary endpoints were the onset of sensory and motor block, duration of motor and sensory blocks, and quality of block and duration of postoperative analgesia.

MATERIALS AND METHODS: After ethical committee approval and informed consent, sixty patients of American Society of Anaesthesiologists (ASA) I-II of either sex, aged 18-60 years scheduled for elective orthopaedic surgeries of upper limb under supraclavicular brachial plexus block were included in this study.

Following patients were excluded from the study:

- Patients on adrenoreceptor agonists or antagonists.
- Known hypersensitivity to the study drugs.
- Uncontrolled diabetes mellitus.
- Bleeding disorders.
- Pre-existing Peripheral neuropathies and,
- Pregnant females.

After insertion of a 20-gauge intravenous cannula in the non-operated arm, a 5 ml/kg/h infusion of 0.9% NaCl solution was started. After standard anaesthesia monitoring, including baseline measurements of heart rate (HR), non-invasive arterial blood pressure, peripheral oxygen saturation (SpO₂), and respiratory rate were recorded before the block was performed. After appropriate patient positioning and strict aseptic and antiseptic precautions midclavicular point, external jugular vein, and subclavian artery pulsation were identified. About 2 cm above the midclavicular point just lateral to subclavian artery pulsation, a 24 gauge 1.5 inch needle was introduced and directed caudal and medially until paraesthesia was encountered, when local anesthetic was injected in this area. Each group consisted of 30 patients and received the drug as follows: Group C received Bupivacaine 0.25% (30 cc) + clonidine 1µg/kg and Group D received Bupivacaine 0.25% (30cc) +dexmedetomidine 1µg/kg. The drug solutions were prepared by an anaesthesiologist not involved in the study. Sensory block was assessed by pinprick test using a 3-point scale: 0 = normal sensation, 1 = loss of sensation of pinprick (analgesia), and 2=loss of sensation of touch (anaesthesia). Motor block was evaluated by Modified Bromage Scale (4=full power in relevant muscle group, 3=reduced power but ability to move muscle group against resistance, 2= ability to move relevant muscle group against gravity but inability to move against resistance, 1=flicker of movement in relevant muscle group, 0 = no movement in relevant group). Patients with block failure or inadequate block were dropped from the study. Sensory and motor blocks were evaluated every 3 min up to 30 min after injection, and then every 30 min after surgery, until they had resolved.

Sensory onset time was defined as the time interval between the end of total local anaesthetic administration and complete sensory block (score 2). Duration of sensory block was defined as the time interval between the end of local anaesthetic administration and the complete resolution of sensory block (normal sensation or score 0). Motor block was defined as no movement in relevant group (Modified Bromage score 0). Duration of motor block was defined as the time interval between the end of local anaesthetic administration and the recovery of full power in relevant muscle group (Modified Bromage score 4). The quality of intraoperative analgesia was judged by the investigator at the end of surgery as excellent (no discomfort or pain), good (mild pain or discomfort, no need for additional analgesics), fair (pain that required additional analgesics), or poor (moderate or severe pain that needed general anaesthesia). Sedation of patients was assessed by Ramsay sedation score. HR, systolic arterial blood pressure (SAP), and diastolic arterial blood pressure (DAP) were recorded at 0, 5, 10, 15, 30, 45, 60, 90, 120, and 150 min.

Adverse events comprised hypotension (a 20% decrease in relation to the baseline value), bradycardia (HR < 50 beats per min), hypoxemia (SpO₂ < 90%), or nausea and vomiting if present were noted and recorded. Pain was assessed using the Numerical Rating Pain Scale (0-10) every 2 hourly in the postoperative period for 24 hours. Nursing staff administered intramuscular (IM) diclofenac 75 mg when the numerical rating pain score > 5. The time between the end of local

ORIGINAL ARTICLE

anaesthetic administration and the first analgesic request was recorded as the duration of the analgesia.

Statistical software used to carry out statistical analysis of data was Statistical Package for Social Sciences (SPSS) version 20. Data were analysed with the help of descriptive statistics viz. mean, standard deviation and percentage. Student independent t-test was employed for quantitative data. For qualitative data chi-square test or Fisher's exact test whichever appropriate, was used. P-value of <0.05 was considered statistically significant.

RESULTS: The demographic data and surgical characteristics were similar in each group [Table 1]. Sensory and motor block onset time was earlier in group D as compared with group C but statistically insignificant [Table 2] ($P < 0.05$). Sensory and motor blockade durations were significantly longer in group D than in group C ($P < 0.001$). The total Duration of analgesia was significantly longer in group D (449 ± 59.504 vs. 283.9 ± 40.416 min) than in group C (Table 2) ($P < 0.001$). Regarding the quality of block, in group C, 13(43.3%) patients achieved Grade-IV of block while 25(83.3%) in group D achieved Grade-IV quality of block (p -value < 0.05). There were a total 17 (56.7%) patients in group-C with Grade-III block and 5(16.7%) patients in group-D with Grade-III block, the difference were highly statistically significant. From the 6th h, patients who received dexmedetomidine, showed a significantly lower numerical rating pain score than the patients received clonidine. Mean arterial pressure and mean pulse rate at 0, 5, 10, 15, 30, 45, 60, 90, 120, and 150 min were variable at each time interval and was lower in dexmedetomidine group but statistically insignificant ($P > 0.05$). All patients were cooperative, oriented and tranquil in both groups at all times of observation intra-operatively. No side effects including nausea, vomiting, hypotension, and hypoxemia were reported in either group.

| Variable | Group C (n=30) | Group D (n=30) | P-value |
|---|----------------|----------------|--------------|
| Age (years) | 36.9±12.225 | 37.2±11.017 | 0.938 (SNSD) |
| Weight (Kgs) | 59.8±6.161 | 62.5±10.358 | 0.219 (SNSD) |
| Sex (M/F) | (20/10) | (19/11) | 0.787 (SNSD) |
| ASA (I/II) | 24/4 | 27/3 | 0.688 |
| Duration of surgery (min) | 126.8±32.591 | 129.5±29.33 | 0.740 |
| Values are expressed as mean ± standard deviation (SD) or absolute numbers, M=male, F=female | | | |

Table 1: Demographic variables in two groups

| Parameter | Group C (n=30) | Group D (N=30) | P value |
|--|----------------|----------------|---------|
| Onset of sensory block (min) | 2.18±0.60 | 1.93±0.44 | 0.064 |
| Total duration of sensory block (min) | 235.9±28.84 | 406.7±61.45 | <0.001 |
| Onset of motor block (min) | 4.30±0.965 | 4.82±1.43 | 0.102 |
| Total duration of motor block (min) | 299.6±41.71 | 497±56.48 | <0.001 |
| Total duration of analgesia (min) | 283.9±40.41 | 499±59.50 | <0.001 |
| Values are expressed as mean ± standard deviation (SD) | | | |

Table 2: Comparison of quality of blocks in two groups

ORIGINAL ARTICLE

DISCUSSION: Supraclavicular brachial plexus block is a very popular mode of anaesthesia for various upper limb surgeries, due to its effectiveness in terms of cost and performance, margin of safety and good post-operative analgesia. Bupivacaine alone provide analgesia for not more than 4-6 h in peripheral nerve blocks. A variety of adjuvants have been studied for brachial plexus blockade.^[5,6,7] Dexmedetomidine, a selective α 2-adrenoceptor agonist, has been used as an adjuvant during regional and local anaesthesia. 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. So, we undertook the present study to compare the effect of dexmedetomidine and clonidine as adjuvants to bupivacaine in supraclavicular brachial plexus block.

In this study, we found that dexmedetomidine prolongs the duration of sensory block, duration of motor block and duration of postoperative analgesia and improves the quality of block as compared to clonidine without any significant adverse effects when used as an adjuvant to bupivacaine in supraclavicular brachial plexus block. The mechanism by which α 2 adrenergic receptor agonists produce analgesia is not fully understood but is likely to be multifactorial. Peripherally, α 2 agonists produce analgesia by reducing release of norepinephrine and causing α 2 receptor-independent inhibitory effects on nerve fibre action potentials. Centrally, α 2 agonists produce 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 the locus coeruleus. ^[8,9] Several studies have found dexmedetomidine to be safe and effective in various neuraxial and regional anaesthetic in procedure in humans.^[10,11,12,13,14]

A dexmedetomidine–lidocaine mixture has been used to provide Bier's block and was shown to improve the quality of anaesthesia and tourniquet pain and reduce postoperative analgesic requirement.^[10,11] Jeby Mathew et al in their study of comparison of dexmedetomidine and clonidine in supraclavicular block, found dexmedetomidine enhances the duration of bupivacaine anaesthesia and analgesia.^[12] Harshavardhan HS also found significant increase in duration of intraoperative anaesthesia and postoperative analgesia In their comparative study of clonidine and dexmedetomidine in supraclavicular block.^[13] Keshav Govind Rao et al in their randomized double blind prospective study observed dexmedetomidine as much better adjuvant in supraclavicular brachial block” as compared to clonidine in terms of intraoperative anaesthesia and total duration of analgesia.^[14] Sarita S Swami et al also reported significantly better quality of block with dexmedetomidine as compared to clonidine.^[15] In this study, heart rate and blood pressure was variable at each time interval and was lower in dexmedetomidine group, however, the difference were not statistically significant (p-value>0.05). Our results were similar to the other studies in which they observed insignificant haemodynamic changes in dexmedetomidine and clonidine groups in their peripheral nerve blocks.^[13,16,17]

CONCLUSION: Dexmedetomidine added to bupivacaine for brachial plexus block significantly prolongs motor and sensory block duration, prolongs duration of postoperative analgesia and quality of block was better as compared to clonidine without any significant adverse effects.

REFERENCES:

1. 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.
2. Singelyn FJ, Dangoisse M, Bartholomee S, Gouverneur JM. Adding clonidine to mepivacaine prolongs the duration of anesthesia and analgesia after brachial plexus block. *Reg Anesth* 1992; 17: 148–50.
3. Kanazi GE, Aouad MT, Jabbour-K Houry SI, Al Jazzar MD, Alameddine MM, Al-aman R, Bulbul M, Baraka AS. Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. *Acta Anaesth Scand* 2006; 50: 222–7.
4. Congedo E, Sgreccia M, De Cosmo G. New drugs for epidural analgesia. *Curr Drug Targets* 2009; 10: 696-706.
5. Wakhlo R, Gupta V, Raina A, Gupta SD, Lahori VU. Supraclavicular plexus block: Effect of adding tramadol or butorphanol as an adjuncts to local anaesthetic on motor and sensory block and duration of post-operative analgesia. *J Anaesth Clin Pharmacol* 2009; 25: 17-20.
6. Iohom G, Machmachi A, Diarra DP, Khatouf M, Boileau S, Dap F, et al. The effects of clonidine added to mepivacaine for paronychia surgery under axillary brachial plexus block. *Anesth Analg* 2005; 100: 1179-83.
7. Lalla RL, Anant S, Nanda HS. Verapamil as an adjunct to local anaesthetic for brachial plexus blocks. *MJAFI* 2010; 66: 22-4.
8. Eisenach JC, De Kock M, Klimscha W. α_2 -adrenergic agonists for regional anesthesia. A clinical review of clonidine (1984–1995). *Anesthesiology* 1996; 85: 655–74.
9. Guo TZ, Jiang JY, Buttermann AE, Maze M. Dexmedetomidine injection into the locus ceruleus produces antinociception. *Anesthesiology* 1996; 84: 873–81.
10. Memics D, Turan A, Karamanlioğlu B, Pamukcu Z, Kurt I. Adding dexmedetomidine to lidocaine for intravenous regional anesthesia. *Anesth Analg* 2004; 98: 835–40.
11. Esmoğlu A, Mizrak A, Akin A, Turk Y, Boyaci A. Addition of dexmedetomidine to lidocaine for intravenous regional anaesthesia. *Eur J Anaesthesiol* 2005; 22: 447–51.
12. Keshav Govind Rao, Pawan Kapoor, Manoj Kumar Chaurasiya and Aparna Shukla. A randomized double blind prospective study to compare clonidine and dexmedetomidine as an adjuvant in supra-clavicular brachial block. *Indian Journal of Fundamental and Applied life sciences* 2014; 4: 226-29.
13. Harshavardhana H S. Efficacy of Dexmedetomidine Compared to Clonidine added to Ropivacaine in Supraclavicular Nerve Blocks: *IJMHS* 2014; 3: 2277-4505.
14. Dr. Jeby Mathew, Dr. R. Gowthaman and Dr. Dhakshinamoorthy. Comparison of dexmedetomidine and clonidine as an adjuvant to local anaesthesia in supraclavicular block. *International Journal of Modern Research and Reviews* 2014; 2: 463-465.
15. Sarita S. Swami, Varshali M. Keniya, Sushma D. Ladi, Ruchika Rao. Comparison of dexmedetomidine and clonidine (α_2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: a randomized double-blind prospective study. *Indian Journal of Anaesthesia* 2012; 56: 243-249.
16. Aliye Esmoğlu, Fusun Yegenoglu, Aynur Akin and Cemil Yildirim Turk. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anesth Analg* 2010; 10: 1-4.

ORIGINAL ARTICLE

17. Rachana Gandhi, Alka Sahah and Ila Patel. Use of dexmedetomidine along with bupivacaine for brachial plexus block. National Journal of Medical Research 2012; 2: 67-69.

AUTHORS:

1. Fayaz Ahmad Munshi
2. Fahmeeda Bano
3. Aftab Ahmad Khan
4. Basharat Saleem
5. Mushtaq Ahmad Rather

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Anaesthesiology & Critical Care, GMC, Srinagar.
2. PG Scholar, Department of Anaesthesiology & Critical Care, GMC, Srinagar.
3. Associate Professor, Department of Anaesthesiology & Critical Care, GMC, Srinagar.

FINANCIAL OR OTHER

COMPETING INTERESTS: None

4. Professor & HOD, Department of Anaesthesiology & Critical Care, GMC, Srinagar.
5. Senior Resident, Department of Anaesthesiology & Critical Care, GMC, Srinagar.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Mushtaq Ahmad Rather,
Senior Resident,
Department of Anesthesiology & Critical Care,
GMC, Srinagar-190006.
E-mail: mushtaqahmad767@gmail.com

Date of Submission: 01/05/2015.
Date of Peer Review: 02/05/2015.
Date of Acceptance: 16/05/2015.
Date of Publishing: 22/05/2015.