

A COMPARITIVE STUDY OF CLONIDINE AND DEXMEDETOMIDINE AS ADJUVANT TO 0.25% BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR DURATION OF ACTION AND HAEMODYNAMIC CHANGESSaurabh Singh¹, Major General H. S. Nanda²**HOW TO CITE THIS ARTICLE:**

Saurabh Singh, Major General H. S. Nanda. "A Comparitive Study of Clonidine and Dexme detomidine as Adjuvant to 0.25% Bupivacaine in Supraclavicular Brachial Plexus Block for Duration of Action and Haemodynamic Changes". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 49, October 02; Page: 11648-11655, DOI: 10.14260/jemds/2014/3530

ABSTRACT: BACKGROUND: Alpha -2 agonists are used in subarachnoid, epidural, regional blocks as additives for their effect on onset, duration and postoperative analgesia.⁽¹⁻³⁾We compared the effects of adding clonidine and dexmedetomidine, as both are alpha -2 agonist, to a 35 ml solution of 0.25% bupivacaine in supraclavicular brachial plexus block. **AIMS:** (i) To compare the duration of sensory & motor blockade between clonidine & dexmedetomidine as adjuvants to 0.25% bupivacaine. (ii) To compare hemodynamic parameters i.e. Heart rate, systolic blood pressure & diastolic blood pressure between the clonidine and dexmedetomidine groups, as adjuvants to 0.25% bupivacaine. **STATISTICAL ANALYSIS:** The data was compiled and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 15. Duration of sensory and motor block, and haemodynamic parameters were subjected to Independent t-test for statistical analysis. P-value < 0.05 was considered as statistically significant and P < 0.001 as highly significant and it was 2 tailed. **METHODS & MATERIAL:** Eighty patients of ASA 1 and 2 posted for upper limb orthopaedic surgeries were enrolled for the study. Patients were divided into two groups, the Clonidine group C and the Dexmedetomidine group D. In group C (n = 40), 0.25% Bupivacaine + 1 µg/kg Clonidine; and in group D (n = 40), 0.25% Bupivacaine + 1µg/kg Dexmedetomidine, with the total volume of drug solution 35 cc. Drug solution were given for supraclavicular brachial plexus block using the peripheral nerve stimulator. The effects of adjuvants on duration of action and haemodynamic changes were compared. **RESULTS:** Demographic data and surgical characteristics were comparable in both the groups. Duration of sensory and motor block was in group D was 637.50±30.19 minutes (min) and 566.62±37.286 min respectively. In group C 294.38±29.74min, and 228.75±18.213 min respectively, which was statistically significant. Haemodynamic parameters i.e. heart rate, systolic blood pressure, and diastolic blood pressure showed significant decrease in Group D at various time intervals intra operatively. **CONCLUSION:** Dexmedetomidine significantly prolonged the duration of action and significant decrease in haemodynamic parameters, but did not require any active intervention for the same.

KEYWORDS: Clonidine, Dexmedetomidine, Duration of action, Haemodynamic changes, Supraclavicular brachial plexus block.

INTRODUCTION: Upper limb orthopaedic surgeries are preferably performed in regional blocks such as brachial plexus block. Primary concern in brachial plexus block being duration of block, as at times surgery gets prolonged and patients have to be repeated with 2nd block or converted to general anaesthesia. This remains a primary concern of anesthesiologist. To pre-empt this situation various

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adjuvants were used in brachial plexus block. In the past two decade reappraisal of regional techniques has resulted;

- 1) Interest in local block with adjuvants that ensure haemodynamic stability.
- 2) Adjuvants that address the concern with appropriate duration of anaesthesia.

Clonidine and Dexmedetomidine both is alpha 2 adrenoreceptor agonist, but dexmedetomidine is eight times more selective for alpha 2 adrenoreceptors than clonidine.⁽⁴⁾In the view of above goals, ethos of the present study was to compare the potentiation of duration of sensory and motor block, if any, of 0.25% bupivacaine, with adjuvants Clonidine and Dexmedetomidine and in terms of hemodynamic stability and safety.

MATERIALS AND METHODS: After the approval of the Hospital Ethical Committee, patients were explained about the drug and only those who gave willful written consent were included in the study. Eighty ASA physical status I and II patients, 18-60 years undergoing upper limb orthopedic surgeries under supraclavicular brachial plexus block were enrolled.

Exclusion criteria were infection at puncture site, bleeding disorder or patient on anticoagulant therapy, operation on shoulder joint, patients with abnormal psychological profile, history of opioid addiction, peripheral neuropathy & neurological deficit, history of convulsions, hepatic dysfunction, renal diseases, phrenic nerve palsy, pneumothorax and ischemic heart disease, failed blocks and patients who were supplemented intra operatively with opioids analgesics etc.

Patients were allocated in this study into two groups. Clonidine group C(n = 40) received 35 ml solution of 0.25% bupivacaine with 1µg/kg clonidine. Dexmedetomidine group D(n = 40) received 35 ml solution of 0.25% bupivacaine and 1µg/kg of dexmedetomidine. The drug solutions were prepared by an anesthesiologist not involved in the study. The anesthesiologist performing the block and observing the patient was blinded to the treatment group. Data collection was done by the same anaesthesiologist who was unaware of the group allocation. An 18 gauge (G) i.v. cannula was inserted in non-operated arm and lactated Ringer's solution was started.

The patients were administered brachial plexus block by supraclavicular route via the subclavian perivascular approach in supine position with arm adducted. Under strict aseptic precautions, the injection site was identified to be 1 cm behind the midpoint of the clavicle, (where the pulsation of the subclavian artery was felt) and infiltrated with 1 ml of 2% lignocaine subcutaneously. Neural localization was achieved by using Fisher and Paykel nerve stimulator, attached 22G 50 mm long stimulating needle.

The location endpoint was a distal motor response, that is, the movement of the fingers and the thumb with an output current of 0.5 mA. During injection of the drug solution, negative aspiration was done every 5 ml to avoid intravascular injection. Plexus block was considered successful when at least two out of the four nerve territories (ulnar, radial, median, and musculocutaneous) were effectively blocked for both sensory and motor block.

Sensory block (four nerve territories) was assessed by pin prick test using a 3-point scale:

- 0 = normal sensation.
- 1 = loss of sensation of pin prick (analgesia).
- 2 = loss of sensation of touch (anaesthesia).

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Motor block was determined by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and flexion of elbow (musculocutaneous nerve) according to the modified Bromage scale⁽⁵⁾ on a 3-point scale:

Grade 0: Normal motor function with full flexion and extension of elbow, wrist, and fingers.

Grade 1: Decreased motor strength with ability to move the fingers only.

Grade 2: Complete motor block with inability to move the fingers.

Both sensory, motor blocks were assessed every minute till the blockade and after that at 15 min intervals starting from the time of completion of injection, until they had resolved. Patients were asked to note the subjective recovery of sensation and movements which was then certified by an anesthesiologist. Protocol for rescue analgesia was identified to a VAS ≥ 5 with i/v tramadol 2mg/kg. Hemodynamic parameters were recorded every 15 min from completion of injection, till 180 minutes.

The data was compiled and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 15. Duration of sensory and motor block, and haemodynamic parameters were subjected to Independent t-test for statistical analysis. P-value < 0.05 was considered as statistically significant and P < 0.001 as highly significant.

RESULTS: The demographic data and surgical characteristics were comparable in both groups (Table 1). The mean duration of sensory block for group D was 611.25 ± 32.890 min, while it was 267.38 ± 20.908 min for group C, Table 2 (Figure 1). Mean duration of motor block in Group D was 566.62 ± 37.286 min while in Group C it was 228.75 ± 18.213 min (Table 3, Figure 2). Independent t test was applied and significance was 2 tailed for both sensory and motor block duration. P value both for sensory and motor block was 0.000, (P < 0.001) which was highly significant.

Heart rate in both groups were compared again by applying Independent t test, the decrease in heart rate in Group D was highly significant at 30, 60, 90 min as compared Group C (Table 4). Heart rate less than 60 was observed in 4 patients at 60 min, 9 patients at 75 min and in 10 patients at 90 min out of 40 (Figure 3). Systolic and Diastolic Blood Pressure when compared, significant decrease (P < 0.001) was observed in Group D than Group C at 60, 90, 120, 150 min. However both parameters did not require any corrective intervention.

DISCUSSION: Dexmedetomidine, the pharmacologically active d-isomer of Medetomidine is a highly specific and selective α_2 adrenoceptor agonist with $\alpha_2:\alpha_1$ binding selectivity ratio of 1620:1 as compared to 220:1 for clonidine, thus decreasing the unwanted side effects of α_1 receptors.^(6,7) Presynaptic activation of α_2 adrenoceptor in central nervous system (CNS) inhibits the release of norepinephrine, terminating the propagation of pain signals and their postsynaptic activation inhibits sympathetic activity.

High selectivity for α_2 A receptors mediates analgesia, sedation, and anxiolysis. Various randomized control trial done so far shows encouraging results for its use in intravenous sedation, as adjuvants in spinal,^(8,9) epidural,⁽¹⁰⁾ caudal anaesthesia,⁽¹¹⁾ Studies by Brummett et al., (2008, 2010) showed that dexmedetomidine enhances duration of bupivacaine anaesthesia and analgesia of sciatic nerve block in rats without any evidence of histopathological damage to the nerve.^(12,13) In another study, dexmedetomidine added to ropivacaine increased the duration of sciatic nerve blockade in rats, most likely due to the blockade of hyperpolarization-activated cation current (i.e., a direct effect

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on the peripheral nerve activity).⁽¹⁴⁾ Kosugi et al., (2010) examined the effects of various adrenoceptor agonists including dexmedetomidine, tetracaine, oxymetazoline and clonidine, and also an α_2 adrenoceptor antagonist (atipamezole) on compound action potential (CAP) recorded from frog sciatic nerve, and found that CAPs were inhibited by α_2 adrenoceptor.⁽¹⁵⁾

Masaki et al., suggested that dexmedetomidine induces vasoconstriction via α_2 adrenoceptors in the human forearm possibly also causing vasoconstriction around the site of injection, delaying the absorption of local anaesthetic and hence prolonging its effect.⁽¹⁶⁾ Esmoğlu et al., (2010) reported prolongation of axillary brachial plexus block when dexmedetomidine was added to levobupivacaine.⁽¹⁷⁾ Yoshitomi et al., demonstrated that dexmedetomidine as well as clonidine enhanced the local anaesthetic action of lignocaine via peripheral α_2 adrenoceptors.⁽¹⁸⁾

In our study we found that both clonidine and dexmedetomidine when added to Bupivacaine for supraclavicular brachial plexus block significantly prolonged duration of sensory and motor block which ruled out the need for any supplementation intra operatively. The added advantage of relatively stable haemodynamics i. e., Without any wide variation, makes them a potential adjuvant for nerve blocks. Dexmedetomidine had longer duration of sensory and motor block than clonidine.

Though there was significant decrease in heart rate, systolic diastolic blood pressure in Group D but active intervention was not required in either of the groups. We conclude that Dexmedetomidine is better than Clonidine in terms of duration of action, causes greater decrease in heart rate and blood pressure, which however did not require any corrective intervention i.e., hemodynamic stability is maintained.

	Group C (n = 40) Mean \pm SD	Group D (n = 40) Mean \pm SD
Age (Years)	32.1 \pm 8.9	31.4 \pm 9.3
Height (Cm)	164.3 \pm 10.2	165.5 \pm 11.1
Weight (Kg)	54.9 \pm 9.2	56.0 \pm 8.4
Gender (M/F)	27/13	24/16

Table 1: Demographic and Surgical characteristics

C = Bupivacaine + Clonidine, D = Bupivacaine + Dexmedetomidine, M= Male, F =Female. There was no significant difference between groups

	Group C (n = 40) (X \pm SD)	Group D (n = 40) (X \pm SD)	P-value Sig. (2 tailed)
Duration of action (min)	267.38 \pm 20.908	611.25 \pm 32.890	0.000

Table 2: Duration of sensory block

Groups C (Bupivacaine + Clonidine) and D (Bupivacaine + Dexmedetomidine)

	Group C (n = 40) (X \pm SD)	Group D (n = 40) (X \pm SD)	P-value Sig. (2 tailed)
Duration of action (min)	228.75 \pm 18.213	566.62 \pm 37.286	0.000

Table 3: Duration of motor block

Groups C (Bupivacaine + Clonidine) and D (Bupivacaine + Dexmedetomidine)

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	0	30	60	90	120	150	180
Group C	84.25	82.55	81.18	80.42	81.5	83.08	84.6
Group D	82.2	73.12	66.12	64.78	76.1	79	81.32
P-value Sig. (2tailed)	0.196	0.000	0.000	0.000	0.002	0.008	0.008

Table : 4 Comparison of heart rate (mean)

HEART RATE (MEAN) AT 30 MIN INTERVALS

	0	30	60	90	120	150	180
Group C (mm Hg)	125.8	122	123.75	125.75	126.55	127.35	128.2
Group D (mm Hg)	123.25	117.4	112.5	108.05	113.85	119.05	122.7
P-value Sig.(2tailed)	0.154	0.006	0.000	0.000	0.000	0.000	0.000

Table 5 : COMPARISION OF SYSTOLIC BLOOD PRESSURE(MEAN)

SYSTOLIC BLOOD PRESSURE (MEAN) AT 30 MIN INTERVALS

	0	30	60	90	120	150	180
Group C (mm Hg)	79.65	78.6	79.6	79.9	80.4	80.75	81.65
Group D (mm Hg)	79.95	74.25	71.95	69.95	73.05	74.65	78.55
P-value Sig. (2tailed)	0.025	0.000	0.000	0.000	0.000	0.000	0.004

Table 6 : COMPARISION OF DIASTOLIC BLOOD PRESSURE (MEAN)

DIASTOLIC BLOOD PRESSURE (MEAN) AT 30 MIN INTERVALS

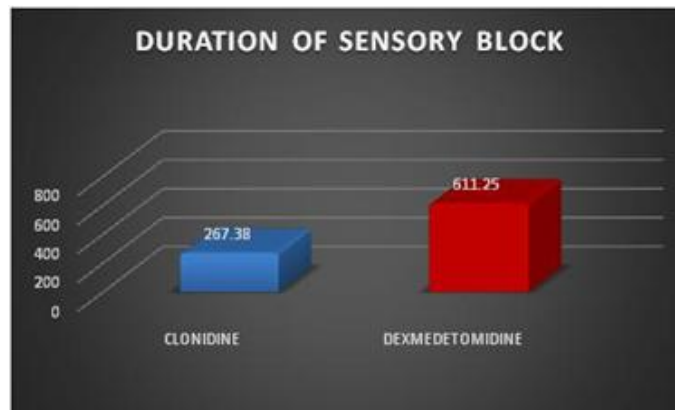


Fig. 1

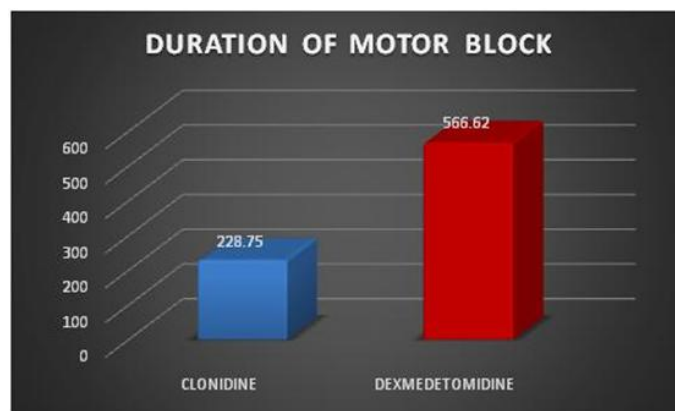


Fig. 2

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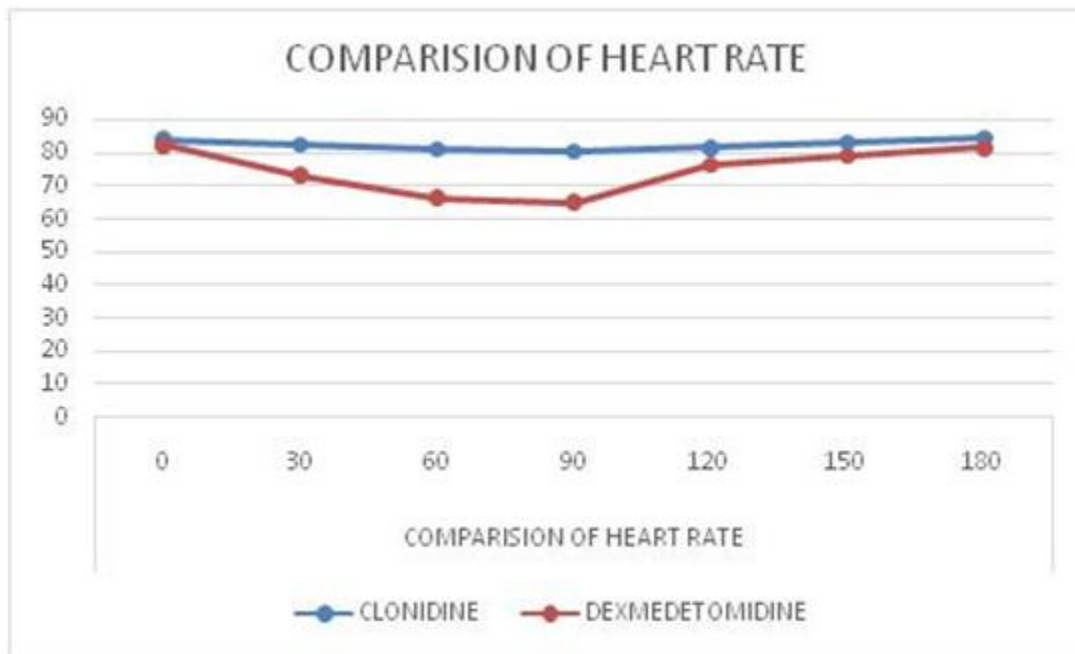


Fig. 3

Comparison of heart rate at 30 min intervals.

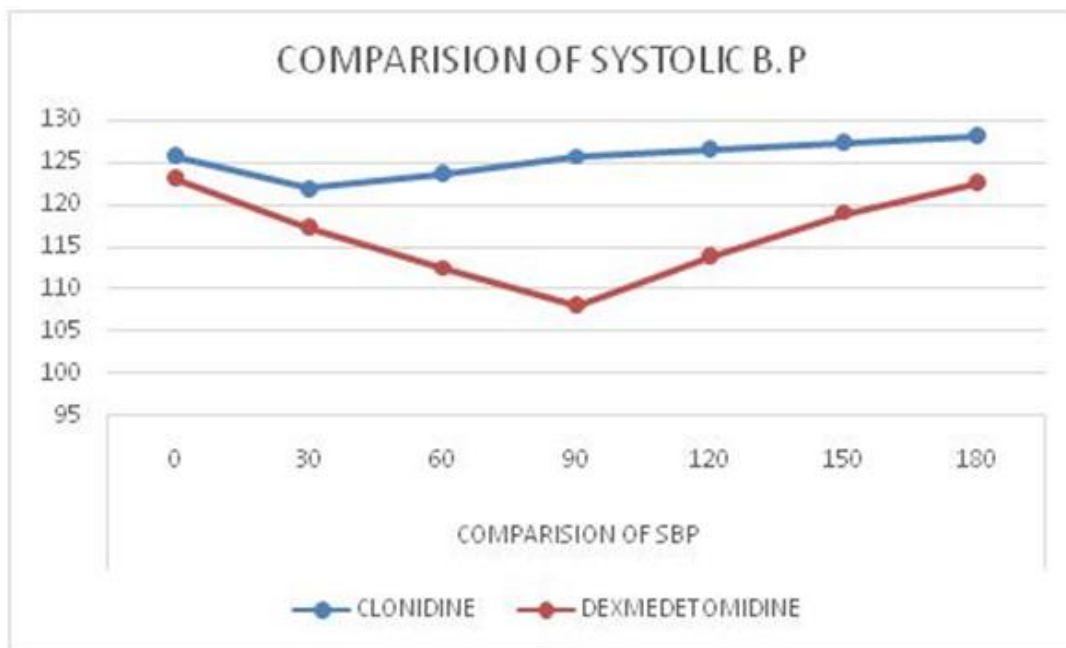


Fig. 4

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Comparison of Systolic Blood Pressure at 30 min intervals.

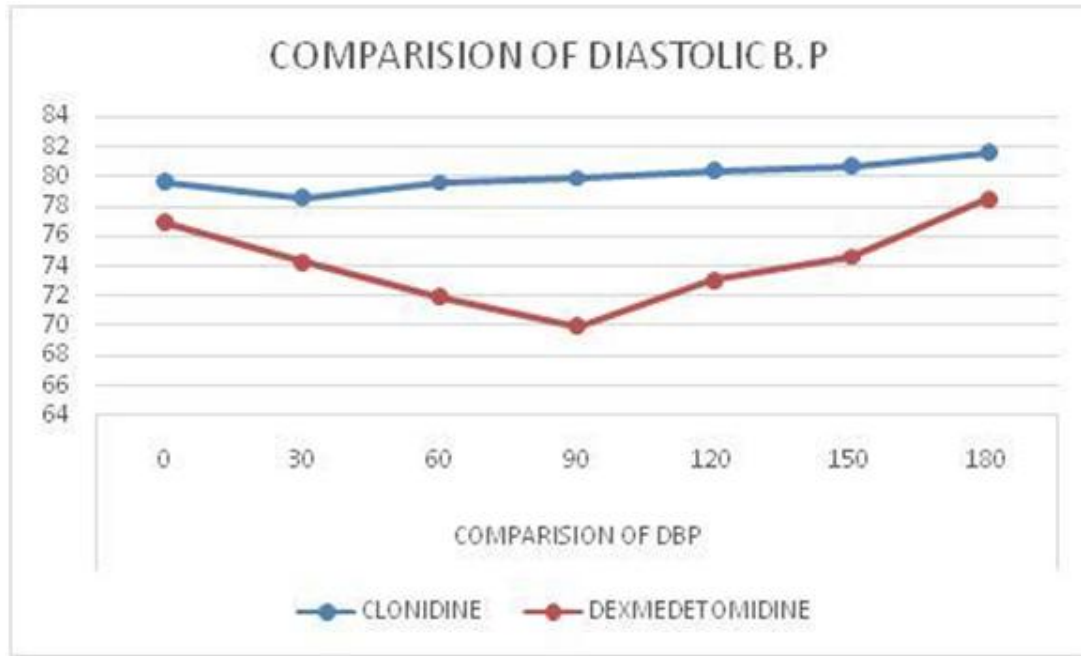


Fig. 5

Comparison of Diastolic Blood Pressure at 30 min intervals.

REFERENCES:

1. Elliott S, Eckersall S, Fliqelstone L. Does addition of clonidine affect duration of analgesia of Bupivacaine in inguinal hernia repair. *Br J Anaesth* 1997;79:446-9.
2. Singelyn FJ, Gouveineur J, Robert A. A minimum dose of clonidine added to mepivacaine prolongs duration analgesia after brachial plexus block. *AnesthAnalg* 1996;83:1046-50.
3. Popping DM, Elia N, Marret E, Wenk M, Tramèr MR. Clonidine as an adjuvant to local anaesthetic for peripheral nerve and plexus blocks: A meta-analysis of randomized trials. *Anesthesiology* 2009;111:406-15.
4. Raimo V, Juha M, Veijo S, Leena N, Virtanen R. Characterisation of selectivity, specificity and potency of medetomidine as α_2 adrenoceptor agonist. *Eur J Pharmacol* 1988;150:9-14.
5. Sarkar DJ, Khurana G, Chaudhary A, Sharma JP. A comparative study on the effects of adding fentanyl and buprenorphine to localanaesthetica in brachial plexus block. *J Clin Diagn Res*2010;4:3337-43.
6. Carollo DS, Nossaman BD, Ramadhyani U. Dexmedetomidine: A review of clinical applications. *CurrOpinAnaesthesiol* 2008;21:457-61.
7. Hall JE, Uhrich TD, Barney JA, Arain SA, Ebert TJ. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. *AnesthAnalg* 2000;90:699-705.

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8. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, et al. Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. *ActaAnesthesiolScand* 2006;50:222-7.
9. Konakci S, Adanir T, Yilmaz G, Rezanko T. The efficacy and neurotoxicity of dexmedetomidine administered via the epidural route. *Eur J Anaesthesiol* 2008;25:403-9.
10. Yazbek-Karam VG, Aouad MA. Perioperative uses of dexmedetomidine. *Middle East J Anesthesiol* 2006;18:1043-58.
11. El-Hennawy AM, Abd-Elwahab AM, Abd-Elmaksoud AM, El-Ozairy HS, Boulis SR. Addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children. *Br J Anaesth* 2009;103:268-74.
12. 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. *Anesthesiology* 2008;109:502-11.
13. 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. *RegAnesth Pain Med* 2010;35:427-31.
14. 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 hyper polarization-activated cation current. *Anesthesiology* 2011;115:836-43.
15. Kosugi T, Mizuta K, Fujita T, Nakashima M, Kumamoto E. High concentrations of dexmedetomidine inhibit compound action potentials in frog sciatic nerve without alpha(2) adrenoceptor activation. *Br J Pharmacol* 2010;160:1662-76.
16. Masuki S, Dinunno FA, Joyner MJ, Eisenarch JH. Selective alpha2- adrenergic properties of dexmedetomidine over clonidine in the human forearm. *J ApplPhysiol* 2005;99:587-92.
17. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *AnaesthAnalg* 2010;111:1548-51.
18. 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. *AnesthAnalg* 2008;107:96-101.

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