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Research Article

The Effects of Clonidine on Ropivacaine in Supraclavicular Brachial Plexus Block

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Abstract: Several clinical studies have shown that clonidine prolongs sensory motor blockade when used with bupivacaine but effect of clonidine on ropivacaine is not well defined. The aim of the study was to evaluate the effect of clonidine on ropivacaine, for supraclavicular brachial plexus blockade. In a prospective randomised double blind placebo controlled study supraclavicular brachial plexus blockade was performed in 80 patients using 35 ml ropivacaine (0.5 %). Group A (n=40) had 150 µg clonidine and in Group B (n=40) 1ml normal saline added to ropivacaine. Sensory and motor blockade was assessed every 5 min till 30 min and at 15 min interval thereafter. Mean sensory onset time in group A was 10.44 ± 5.7 min and in group B was 15.85 ± 6.55 min, which was statistically significant. Patients of group A had a mean motor onset time 14.35 ± 7.8 min and patients of group B had a mean motor onset time 18.55 ± 7.64 min, the difference being statistically significant. Mean duration of sensory block in group A was 484.15 ± 63.4 min and in group B was 390.85 ± 72.65 min, which was statistically significant. Patients in group A had a mean duration of motor block 550 ±60.3 min and patients in group B had a mean duration of motor block 430.45±68.7 min, which was statistically significant. In conclusion, the addition of clonidine to ropivacaine, for brachial plexus blockade, increases the onset and duration of motor and sensory block.
Keywords: Ropivacaine, Clonidine, brachial plexus

INTRODUCTION

Brachial plexus block provides both intraoperative anaesthesia and postoperative analgesia without any systemic side-effects [1]. Ropivacaine has lower lipid solubility and have produced less central nervous system toxicity and cardiotoxicity than bupivacaine for which it is gaining popularity over bupivacaine for peripheral nerve blocks [2.] There has always been a search for ideal adjuvant to local anaesthetics for regional nerve block that prolong the analgesia with lesser adverse effects [3]. Several clinical studies have shown that clonidine can prolong the duration of analgesia when used in combination with local anaesthetic agents like bupivacaine [4]. Previous studies on the effect of adding clonidine to ropivacaine has shown conflicting result in different nerve blocks. Some study shows potentiation of block and some study show no impact [5]. As further research is required on this, we planned to evaluate the effect of adding clonidine to ropivacaine in supraclavicular brachial plexus block.

METHODOLOGY

Following approval from the local hospital ethics committee, we conducted this study in the Department of anaesthesiology and critical care, SCB Medical College, Hospital from october 2012 october 2013. Eighty patients of American Society of Anesthesiologists (ASA) grade I or II posted for hand or forearm surgery were recruited to a prospective randomised, double blind, placebo controlled study.

Exclusion criteria were patients of age <18 yr or >60 yr,patients receiving anticoagulants, patients with history of hypertension, peripheral neuropathy and hypersensitivity to local anesthetic agents.

Details of the anesthetic technique and the study protocol were fully explained to patients during preanaesthetic check-up and informed written consent was obtained from each patient. Relevant investigations were performed as required. 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.

Patients, randomly allocated by computer generated randomisation list divided into two groups A and B.

- Group A(n=40)- ropivacaine 0.5% (35 ML) with 150 µg clonidine(1ml)
- Group B (n=40)- ropivacaine 0.5% (35 ML) with 1 ml normal saline

Identical syringes were loaded with 1 ml of either clonidine or normal saline and labelled by the anaesthesiologist, not involved in nerve block.

On arrival in the operation room, baseline heart rate, blood pressure and oxygen saturation were recorded and monitored throughout the procedure. An intravenous line was secured in the unaffected limb and Ringer's lactate was started. All the patients received brachial plexus block through the supraclavicular approach by an experienced anaesthesiologist using nerve locator. Following negative aspiration, 35mL of a solution containing local anaesthetic combined with clonidine or normal saline was injected. A 3-min massage was performed to facilitate an even drug distribution.

Sensory block was assessed by the pin prick method. Assessment of sensory block was done at every 5 minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade. Sensory onset was considered when there was a dull sensation to pin prick with a 23G needle along the distribution of any of the above-mentioned nerves. Complete sensory block was considered when there was complete loss of sensation to pin prick

Sensory block was graded as-[6]

- Grade 0: Sharp pin felt
- Grade 1: Analgesia, dull sensation felt
- Grade 2: Anaesthesia, no sensation felt.

Assessment of motor block was carried out by the same observer at each 5 minute till complete motor blockade after drug injection. Onset of motor blockade was considered when there was Grade 1 motor blockade. Peak motor block was considered when there was Grade 2 motor blockade. Motor block was determined according to a modified Bromage scale for upper extremities on a 3-point scale [7].

- 0 − normal motor function with full extension and flexion of elbow, wrist, and fingers,
- 1 − decreased motor strength, with ability to move only fingers,
- 2 − complete motor block with inability to move elbow, wrist, and fingers
-

The block was considered incomplete when any of the segments supplied by median, radial, ulnar and musculocutaneous nerve did not have analgesia even after 30 min of drug injection. These patients were supplemented with intravenous fentanyl (1 µg/ kg) and midazolam (0.02 mg/kg). When more than one nerve remained unaffected, it was considered a failed block. In this case, general anaesthesia was given .Patients were monitored for haemodynamic variables such as heart rate, blood pressure and oxygen saturation every 15 min after the block intraoperatively and every 60 min post-operatively. Sedation of patient was assessed by the Ramsay Sedation Score [8].

Assessment of blood loss was done and fluid was administered as per the loss. The intra- and post-operative assessment was done by an anaesthesiologist who was unaware of the drug used. Patients were assessed for duration of analgesia as per visual analogue scale of 0 to 10. The visual analogue scale was recorded post-operatively every 30 min till the score of 5. The rescue analgesia was given in the form of inj. IV paracetamol at the visual analogue scale of 5 and the time of administration was noted. All patients were observed for any side-effects like sedation, nausea, vomiting, dryness of mouth and complications like pneumothorax, haematoma, local anaesthetic toxicity.

The duration of sensory block was defined as the time interval between the end of local anaesthetic administration and the complete resolution of anaesthesia on all nerves. The duration of motor block was defined as the time interval between the end of local anaesthetic administration and the recovery of complete motor function of the hand and forearm.

Statistical analysis

Results are expressed as mean ± standard deviation. Chi-square test was applied for demographic data, haemodynamic parameters. Onset and duration of sensory and motor blockade and duration of analgesia was analysed by unpaired t- test. Statistical analysis was performed by SPSS (VERSION 16). *P*-value was considered significant if <0.05 and highly significant if <0.001.

RESULTS

There was no statistically significant difference between the demographics (age, sex, ,height,weight, ASA grade, duration of surgery)**.**Also there was no statistical significance in baseline parameters like heart rate, systolic blood pressure,diastolic blood pressure,mean atrial pressure and oxygen saturation (Table I). Eighty patients were studied. Of these two patients were excluded from each group for incomplete / failed block to whom general anesthesia was administered.

Parametric data expressed as mean±standard deviation, categorical data (sex) expressed as frequency (%) using Chi-square analysis. P<0.05: Statistically significant. ASA= American society of anaesthesiologists, BPM=Beats per minute, SBP=Systolic blood pressure, DBP=diastolic blood pressure, MAP=mean arterial pressure, SPO_2= oxygen saturation.

No statistical difference was noted in the hemodynamic parameters (mean HR, MAP, SpO_2) before and after giving the block, throughout the surgery and postoperatively (fig. 1,2).

Table 1: Distribution of subject according to demographic profile and vital signs

	Group A	Group B	P value
Age (year)	30.6±10.2	32.5±9.6	0.3936
Sex ratio (M/F)	32/8	30/10	0.7895
Weight (kg)	60.4±11.42	61.2±10.64	0.7467
Height (cm)	162±12.64	164.3±11.68	0.4006
ASA Grade (I/II)	30/10	32/8	0.7895
Duration of Surgery (min)	92.6±28.4	91.8±29.6	0.9022
Base line heart rate (BPM)	79.2±14.4	80.4±13.8	0.7046
Base line SBP (mm of Hg)	126.0±8.9	124.4±9.1	0.4290
Base line DBP (mm of Hg)	78.3±8.4	77.6±7.6	0.6970
Base line MAP (mm of Hg)	91.6±7.8	92.1±8.2	0.7807
Base line SPO_2 (%)	97.2±1.4	97.6±1.2	0.1740

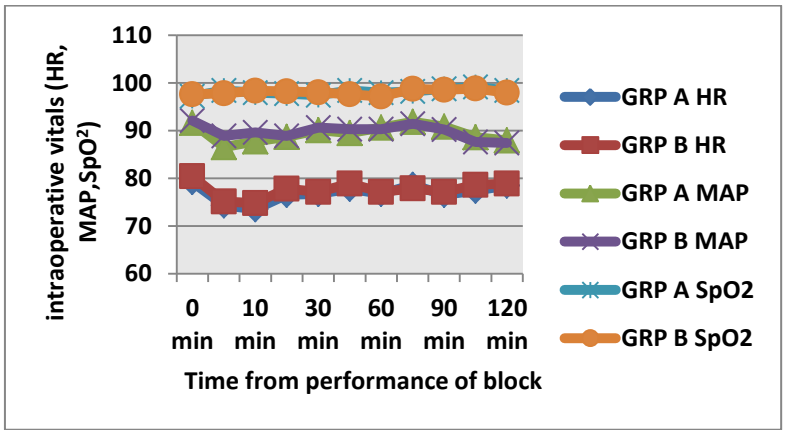

Fig. 1: Comparison of intraoperative vitals (heart rate, mean arterial pressure, and oxygen saturation) in between Group A and Group B

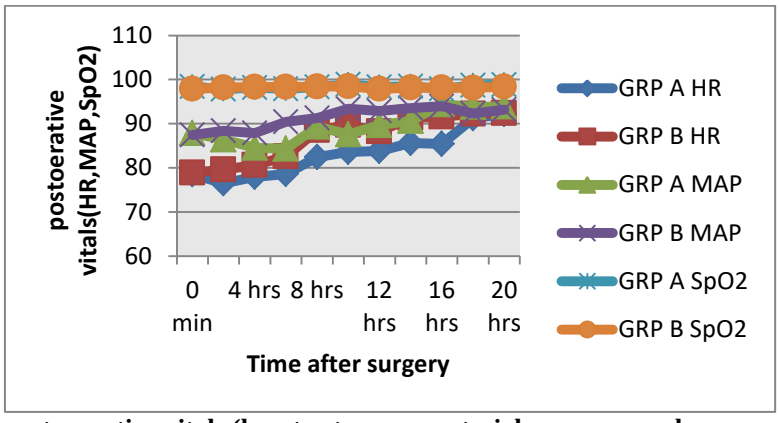

Fig. 2: Comparison of postoperative vitals (heart rate, mean arterial pressure, and oxygen saturation) in between Group A and Group B

Table 2: Characteristics of sensory and motor block in group A and group B

	Group A Mean ±SD	Group B Mean ±SD	P value
Onset of sensory block (min)	10.44±5.7	15.85±6.55	0.0002
Onset of motor block (min)	14.35±7.8	18.55±7.64	0.0173
Duration of sensory block (min)	484.15±63.4	390.85±72.65	0.0001
Duration of motor block (min)	550 ±60.3	430.45±68.7	0.0001
Duration of analgesia (min)	586±56.8	465.8±62.5	0.0001

Data expressed as mean ± standard deviation. P<0.05= statistically significant

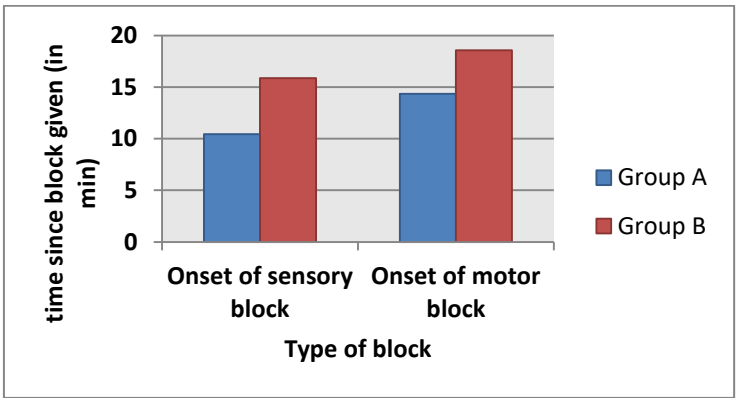

Fig. 3: Comparison between Group A and Group B for time of onset for sensory and motor block

The onset of block was earlier in group A patients ,that was 10.44 ± 5.7 min for sensory block and 14.35 ± 7.8 min for motor block than those in group B 15.85 ± 6.55 min for sensory block and 18.55 ± 7.64 min for motor block, which was statistically significant ($P < 0.05$)(table 2)(fig. 3).

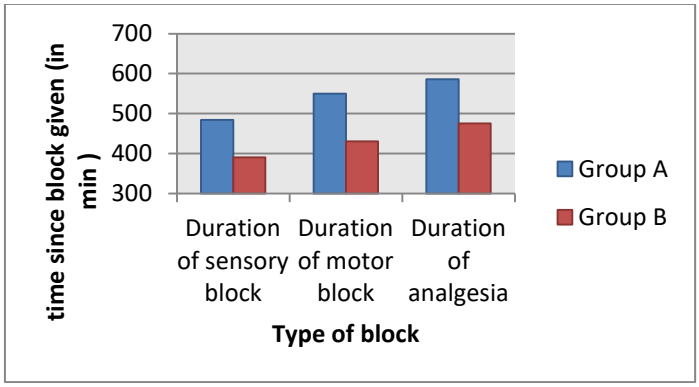

Fig. 4: Comparison between Group A and Group B for duration of sensory, motor block and analgesia

Mean duration of sensory block in group A was 484.15±63.4 min and in group B was 390.85±72.65min. Patients belonging to group A had a mean duration of motor block 550 ±60.3min and group B had a mean duration of motor block 430.45±68.7min, which was statistically significant (table 2) (fig. 4). Postoperative analgesia lasted 586±56.8min in group A and 465.8±62.5 min group B which was also statistically significant ($P < 0.05$).

Sedation score of patients in group A (42.5%) were higher than those in group B (15%) intraoperatively and postoperatively and this was statistically significant ($P < 0.05$).

DISCUSSION

The analgesic properties of clonidine when administered intrathecally or epidurally as adjuvant have been well demonstrated [9].They seem to be attributable to its α2-agonist properties. Its action on large no α2 receptors present in the central nervous system, at loecus coeruleus and dorsal horn of the spinal cord, is the main mechanism of centrally mediated sedation and analgesia [10]. Specific peripheral effects of clonidine appear less obvious because α2-adrenoreceptors are not present on the axon of the normal peripheral nerve [10]. It has been postulated that clonidine improved the duration of postoperative analgesia only when used as an adjuvant to intermediate-acting local anaesthetics and that it was not worthwhile to combine it with long-acting local anaesthetics.

Two reviews have addressed this issue [11, 12]. Murphy *et al.* [11] analyzed randomized trials that investigated the usefulness of a variety of adjuvants, including clonidine added to local anaesthetics for brachial plexus block. On the basis of data from six trials (349 patients), they concluded that clonidine in doses up to 150 μg increased the duration of postoperative analgesia with minimal adverse effects .McCartney *et al.* [12] reviewed 27studies (1,385 patients) using clonidine as an adjuvant to local anaesthetics for a variety of peripheral nerve blocks. They concluded that clonidine was beneficial only when added to intermediate-acting local anaesthetics.

In this randomized, double-blinded trial, we compared clonidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block, and found that there was significant decrease in onset and increase in duration of sensory and motor blockade in the clonidine

group in comparision to saline group.In the present study in group A (clonidine) mean onset time of sensory block was 1O.44 ± 5.70 minutes and In group B(saline) it is 15.85 ± 6.55 min. Mean onset of motor block was 14.35 ± 7.8 minutes in group A(clonidine) and 18.55 ± 7.64 min in group B(saline) .(Table 2) . Mean duration of sensory block and motor block in patients of group A (clonidine) was 484.15 ± 63.40 minutes and 550 ±60.3minutes respectively (table 2). Mean duration of sensory block and motor block in patients of group B (saline) was 390.85 ± 72.65 minutes and 430.45±68.7 minutes respectively. The difference in both the groups is statistically significant. Postoperative analgesia lasted 586+56.8min in group A and 465.8+62.5 min group B which was also statistically significant ($P < 0.05$). The results of present study in regards to onset of sensory block and motor block are in agrrement with study by Antonucci S and its duration of sensory motor blockade in group A are in agreement with study of El Saied *et al.*[14].

Antonucci S [13] evaluated effects of tramadol used as adiuvant in brachial plexus block and compared with clonidine and sufentanil. He used ropivacaine for block and concluded that tramadol as adiuvant provides a significative redution of onset time of sensory motor block and also provides a prolongation of anesthesia and analgesia with a quality of block similar that obtained with clonidine and sufentanil.

El Saied *et a*l. [14] conducted a study in which axillary brachial plexus blockade was performed in 50 patients using 40 ml ropivacaine 0.75 %. Group (A) had 150 µg clonidine and Group (B) 1ml normal saline added to the local anesthetic. There was no difference in onset of sensory motor blockade. They concluded that the addition of 150 µg of clonidine to ropivacaine, for brachial plexus blockade, prolongs motor and sensory block and analgesia, without an increased incidence of side effects.

Giovanni Cucchiaro *et al.* [15], evaluated the effects of clonidine on the duration of sensory and motor block and analgesia time in 215 children who underwent a variety of peripheral nerve block including brachial plexus block and concluded that the addition of clonidine to bupivacaine and ropivacaine can extend sensory block by a few hours, and increase the duration of motor blocks

Casati *et a*l. [16] added low dose clonidine to ropivacaine (0.75%) in sciatic-femoral nerve block for foot surgery. They found that addition of 1 µg /kg clonidine to 0.75% ropivacaine prolongs the duration of postoperative analgesia by 3 h, with only a slight and short-lived increase in the degree of sedation and no hemodynamic adverse effects

Casati *et al.* [17] has done a prospective, randomized, double-blind study in which he evaluated the effects of adding 1 µg/kg clonidine to 20 ml of ropivacaine 0.75% for axillary brachial plexus anesthesia. They concluded that adding 1 µg/kg clonidine to 20 ml of ropivacaine 0.75% for axillary brachial plexus anesthesia provided a 3 hour delay in first analgesic request postoperatively, without clinically relevant effects on the degree of sedation and cardiovascular homeostasis.

Danelli G *et al.* [18] evaluated the effects of adding 50 µg clonidine to 150 mg ropivacaine for superficial cervical plexus block in patients undergoing elective carotid endarterectomy. They opined that adding 50 µg clonidine to 150 mg ropivacaine for superficial cervical plexus block shortened the onset time and improved the quality of surgical anesthesia.

Mehdi Trifa *et al.* [19] added clonidine to ropivacaine in axillary plexus block in 60 patients of 1-6 yr age group. They concluded that ropivacaine (0.2%) 0.4 ml/kg for axillary plexus block provides sufficient postoperative analgesia in children scheduled for forearm or hand surgery. The addition of clonidine increased the time to first analgesia request.

Marhofer D *et al.* [20] evaluated dexmedetomidine as an adjuvant to ropivacaine in peripheral nerve block. Profound prolongation of ulnar nerve block was detected with perineural dexmedetomidine when added to 0.75% ropivacaine.

Brummett CM *et al.* [21] found that dexmedetomidine when added to ropivacaine in peripheral nerve block caused approximately a 75% increase in the duration of analgesia.

The above studies show that selective α_2-adrenoceptor agonist like clonidine or dexmedetomidine when added as adjuvant to ropivacaine in different peripheral nerve blocks potentiates the sensory motor blockade. The 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. 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 neurone and by activation of α2-adrenoceptors in locus coeruleus [5]. So the action of clonidine would then more likely be via a synergistic mechanism of action in combination with the local anesthetic resulting in the prolonged effect.

There are few studies which did not found any impact of clonidine when added to ropivacaine in peripheral nerve blocks.

Erlacher W *et al.* [22] in 2000 studied the efficacy of clonidine on ropivacaine in axillary plexus block .They found that there was no significant impact

on onset/duration of sensory and motor blockade in clonidine group

Erlacher W *et al.* [23] in 2001 evaluated clonidine as adjuvant for mepivacaine,ropivacaine and bupivacaine in axillary plexus block and opined that clonidine prolonged both sensory and motor blockade of mepivacaine and bupivacaine but not ropivacaine.

Jaiswal *et al.* [24] evaluated the effect of adding clonidine (150 µg) to ropivacaine (0.5%) for axillary plexus blockade among 60 patients and found that addition of clonidine (150 microgram) is of no benefit in the onset and duration of both sensory and motor block.

The limitation of present study was small sample size and ropivacaine or clonidine was not used as per body weight in kg.

CONCLUSION

In conclusion, clonidine added to ropivacaine is an attractive option for improving the quality and duration of supraclavicular brachial plexus block in upper limb surgeries. Clonidine in supraclavicular brachial plexus block not only hastens the onset, but also prolongs the duration of sensorimotor blockade, and provides a longer pain-free period without significant hemodynamic alterations. As it has more sedative potential, it can reduce patient anxiety and provide optimal intraoperative and postoperative patient comfort.

REFERENCES

1. Khanduri KC; Regional anaesthetic techniques for orthopaedic surgeries. Med J Armed Forces India, 2008; 64:109
2. Akerman B, Hellberg IB; Primary evaluation of the local anesthetic properties of the amino amide agent ropivacaine. Acta Anaesthesiol Scand., 1988; 32: 571-578.
3. Damien B, Murhy, Collin JL, Cartney, Vincent WS; Novel analgesic adjuvants for brachial plexus block. A systemic review. Anesth Analg., 2000; 90: 1122-1128.
4. 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: 552-557.
5. Popping DM, Elia N, Marret E, Wenk M; Clonidine as an Adjuvant to Local Anesthetics for Peripheral Nerve and Plexus Blocks**,**A Meta-analysis of Randomized Trials .Anesthesiology, 2009; 111:406–415
6. Swami SS , Keniya VM, Ladi SD ,Rao R; Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian Journal of Anaesthesia, 2012; 56: 3:243-249.
7. Kohli S, Kaur M, Sahoo S, Vajifdar H, Kohli P; Brachial plexus block: Comparison of two different doses of clonidine added to bupivacaine. Journal of Anaesthesiology Clinical Pharmacology, 2013; 29(4): 491-495.
8. Ramsay MA, Savage TM, Simpson BR, Godwin R; Controlled sedation with alphaxolone-alphadolone. Br Med J., 1974; 2: 656-659.
9. Elia N, Culebras X, Mazza C, Schiffer E, Trame`r MR; Clonidine as an adjuvant to intrathecal local anesthetics for surgery: Systematic review of randomized trials. Reg Anesth Pain Med., 2008; 33: 159–167.
10. Eisenach JC, De Kock M, Klimscha W; α_{2}-adrenergic agonists for regional anesthesia: A clinical review of clonidine. Anesthesiology, 1996; 85: 655–674.
11. McCartney CJ, Duggan E, Apatu E; Should we add clonidine to local anesthetic for peripheral nerve blockade? A qualitative systematic review of the literature. Reg Anesth Pain Med., 2007; 32: 330–338.
12. Murphy DB, McCartney CJ, Chan VW; Novel analgesic adjuncts for brachial plexus block: A systematic review. Anesth Analg., 2000; 90: 1122–1128.
13. Antonucci S; Adiuvants in the axillary brachial plexus blockade- Comparison between clonidine, sufentanil and tramadol. Minerva Anestesiol., 2001; 67: 23–27.
14. El Saied AH, Steyn MP, Ansermino JM; Clonidine prolongs the effect of ropivacaine for axillary brachial plexus blockade. Can J Anaesth., 2000; 47(10): 962–967.
15. Cucchiaro G, Ganesh A; The effects of clonidine on postoperative analgesia after peripheral nerve blockade in children.Anesthesia and analgesia, 2007; 104(3): 532-537.
16. Casati A, Magistris L, Fanelli G, Beccaria P, Cappelleri G, Aldegheri G *et al.*; Small-dose clonidine prolongs postoperative analgesia after sciatic-femoral nerve block with 0.75% ropivacaine for foot surgery. Anesth Analg., 2000; 91: 388–392.
17. Casati A, Magistris L, Beccaria P, Cappelleri G, Aldegheri G, Fanelli G; Improving postoperative analgesia after axillary brachial plexus anesthesia with 0.75% ropivacaine: A double-blind evaluation of adding clonidine. Minerva Anestesiol., 2001; 67: 407–412.
18. Danelli G, Nuzzi M, Salcuni PF, Caberti L, Berti M, Rossini E *et al.*; Does clonidine 50 µg improve cervical plexus block obtained with ropivacaine 150 mg for carotid

endarterectomy? A randomized, double-blinded study. J Clin Anesth., 2006; 18(8): 585-588.

19. Trifa M, Khalifa SB, Jendoubi A, Zribi N, Regaya T, Engelhardt T; Clonidine does not improve quality of ropivacaine axillary brachial plexus block in children Pediatric Anesthesia, 2012; 22(5): 425-429.
20. Marhofer D, Kettner SC, Marhofer P, Pils S, Weber M, Zeitlinger M; Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: a volunteer study. Br J Anaesth., 2013; 110(3): 438-442.
21. 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: 836–843.
22. Erlacher W, Schuschnig C, Orlicek F, Marhofer P, Koinig H, Kapral S; The effects of clonidine on ropivacaine 0.75% in axillary perivascular brachial plexus block. Acta Anaesthesiol Scand., 2000; 44(1):53-55.
23. Erlacher W, Schuschnig C, Koinig H, Marhofer P, Melischek M, Mayer N *et al.*; Clonidine as adjuvant for mepivacaine, ropivacaine and bupivacaine in axillary, perivascular brachial plexus block. Can J Anaesth., 2001 ; 48(6): 522-525.
24. Jaiswal R, Bansal T, Mehta S; A study to evaluate the effect of adding clonidine to ropivacaine for axillary plexus blockade. Asian Journal of Pharmaceutical and Clinical Research, 2013; 6(3):166-168.