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Research Article

COMPARATIVE STUDY OF BUPIVACAINE WITH DEXMEDETOMIDINE VERSUS BUPIVACAINE WITH CLONIDINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

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ABSTRACT

Objective: To compare the efficacy of clonidine with dexmedetomidine as an adjunct to bupivacaine in patients undergoing upper limb surgeries under supraclavicular brachial plexus block.

Methods: This was a prospective comparative study conducted in the department of anesthesiology of a tertiary care medical institute. 80 patients undergoing various upper-limb surgeries were included in this study. Patients were divided into two groups on the basis of whether they received Clonidine (Group C) or Dexmedetomidine (Group D) as an adjuvant to Bupivacaine for supraclavicular block. The onset as well as duration of sensory and motor blockade, duration of analgesia, quality of anesthesia, hemodynamics, and adverse effects were compared between the two groups. $p<0.05$ was considered statistically significant.

Results: The gender distribution of cases in Group C and Group D was found to be comparable, with no statistically significant difference. The mean age of patients in both groups was found to be comparable with no significant difference ($p=0.5671$). The most common types of surgeries in the studied cases were those of the lower radius and ulna (28.75%), followed by the lower humerus (21.25%), upper radius, and ulna (20%). The mean duration of sensory and motor block and duration of analgesia were found to be higher in group D as compared to group C, and the difference was found to be statistically highly significant ($p<0.0001$). The quality of anesthesia was better in patients who received dexmedetomidine as compared to those who received clonidine with Bupivacaine.

Conclusion: Dexmedetomidine used as an adjuvant with bupivacaine for brachial plexus block is associated with prolonged duration of sensory as well as motor block and duration of analgesia as compared to when clonidine is used as an adjuvant. It is also associated with a better quality of anesthesia.

Keywords: Dexmedetomidine, Clonidine, Brachial plexus block, Quality of anesthesia.

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INTRODUCTION

Regional anesthetic techniques are becoming increasingly popular in contemporary anesthesia practice. These methods provide numerous benefits compared to general anesthesia, including diminished systemic side effects, enhanced postoperative pain management, accelerated recovery, and quicker patient mobilization. Supraclavicular brachial plexus block has emerged as a reliable and effective regional anesthesia technique for upper limb surgeries [1]. This approach involves the deposition of local anesthetics around the brachial plexus trunks at the supraclavicular fossa, resulting in complete anesthesia for the entire upper limb. First described by Kulenkampff in 1911, the technique has evolved over the years. It has gained popularity for its numerous advantages in comparison to other anesthetic methods for upper limb surgeries [2].

A supraclavicular brachial plexus block precisely blocks the brachial plexus trunks and yields a rapid onset of anesthesia. It is particularly suitable for hand, wrist, forearm, and elbow procedures [3]. in addition, ultrasound guidance enhances the accuracy and safety of the block. Another advantage of this technique is the avoidance of systemic opioids, which reduces postoperative nausea and sedation, promoting early ambulation. Though there are very few absolute contraindications for supraclavicular block, precaution is needed for patients with chronic pulmonary conditions, as the dispersion of local anesthesia may lead to instances of diaphragmatic paresis. In addition, it is advisable to refrain from administering a regional block if there are preexisting neural deficits within the area covered by the block [4].

The choice of local anesthetic drugs as well as adjuvants, plays an important role in achieving the desired effects while minimizing adverse effects. Various drugs can be used for supraclavicular blocks; however, while selecting these drugs, it must be kept in mind that each drug comes with its own set of properties and characteristics [5]. The use of adjuvants causes prolongation of the duration of anesthesia, enhances the quality of the block, and reduces the requirement for the concentration of local anesthetic drugs. All these properties ultimately have the effect of minimizing systemic toxicity [6].

Clonidine, an alpha-2 adrenergic agonist, has been extensively used as an adjuvant to bupivacaine in supraclavicular blocks. Clonidine's pharmacological properties make it a preferred adjuvant for augmenting the effects of bupivacaine. By interacting with presynaptic alpha-2 receptors, clonidine inhibits the release of norepinephrine, leading to antinociceptive effects [7]. Dexmedetomidine is another alpha-2 adrenergic agonist that is also frequently used as an adjuvant for regional anesthesia. Its pharmacological profile is similar to that of clonidine but with a higher selectivity for alpha-2 receptors [8]. Its use as an adjuvant in supraclavicular blocks is associated with better sedative, analgesic, and sympatholytic effects. These properties contribute to a more prolonged and effective supraclavicular block when combined with bupivacaine [9].

A comparative analysis of clonidine and dexmedetomidine in supraclavicular blocks is important to know the benefits and potential side effects when used as an adjuvant with bupivacaine [10]. Other than benefits and side effects, factors such as the onset and duration of sensory and motor blockade, postoperative analgesia, and hemodynamic stability need to be compared. An informed decision regarding the choice of adjuvant can be made on the basis of these factors as well as patient characteristics and surgical requirements [11].

With this background, we undertook this comparative study of clonidine and dexmedetomidine as adjuvants to be used with bupivacaine in supraclavicular brachial plexus blocks.

Aims and objectives

To compare the efficacy of clonidine and dexmedetomidine as adjuncts to bupivacaine in supraclavicular brachial plexus block in patients undergoing upper limb surgeries.

METHODS

This was a prospective comparative study undertaken in the department of anesthesiology of a tertiary care hospital. 60 patients undergoing upper limb surgeries were included in this study. The sample size was determined on the basis of pilot studies conducted on the topic of brachial plexus block for upper limb surgeries, assuming a power of 90% and a confidence interval of 95%. The calculated sample size required was 30 patients for each arm. Following the central limit theorem, a sample size exceeding 30 was deemed sufficient, and consequently, 40 patients were enrolled in each group. Computer-based randomization was used to ensure random allocation of participants, and anesthetists as well as surgeons remained unaware of the allocation information.

Group C: 40 patients undergoing upper limb surgeries under supraclavicular block with 0.25% Bupivacaine (29 mL) plus 1 mL (1 μg/kg) clonidine to make a total volume of 30 mL.

Group D: 40 patients undergoing upper limb surgeries under supraclavicular block with 0.25% Bupivacaine (29 mL) plus 1 mL (1 μg/kg) dexmedetomidine to make a total volume of 30 mL.

Continuous monitoring of vital signs, including pulse rate, respiratory rate, blood pressure (BP), and oxygen saturation (SpO_2), was done at every 5-min interval for the initial 30-min post-brachial plexus block. Subsequently, monitoring intervals were extended to 15 min, lasting up to 180 min. Hypotension was defined as a reduction in systolic BP (SBP) by more than 30% from baseline or falling below 90 mm of Hg. Satisfactory anesthesia was characterized by the absence of reported pain or discomfort during surgery, eliminating the need for intraoperative sedation. Postoperatively, vigilant monitoring continued in the recovery room and postoperative ward. The duration of analgesia was assessed using a 0–10 visual analog score (VAS) at 30-min intervals for the initial 10 h and hourly up to 24 h. A VAS score above 5 prompted the administration of rescue analgesia (intramuscular Diclofenac at 1–1.5 mg/kg). Onset and duration of sensory as well as motor blocks were recorded and compared between groups. The quality of the analgesia as well as any side effects were also compared.

Data analysis was done with SPSS 21.0 software. Group comparison was made using an independent sample t-test for continuously distributed data and a chi-square test for the assessment of categorical data. Repeated observations were compared using a paired t-test or repeated measures analysis of variance. $p<0.05$ was considered statistically significant.

Inclusion criteria

1. Patients undergoing various upper-limb surgeries under brachial plexus block
2. Age above 18 years
3. Those who gave informed written consent to be part of the study
4. ASA Grade I and II patients.

Exclusion criteria

1. Those who refused consent to be part of the study
2. Age below 18 years
3. ASA III or above patients
4. Patients with a known allergy to any of the study drugs
5. Patients with autoimmune diseases, i.e., rheumatoid arthritis, autoimmune arthritis, polymyositis, etc., likely to affect the assessment of patients
6. Patients with contraindications to brachial plexus block, such as significant bleeding disorders, coagulopathies, or chronic respiratory illnesses
7. Psychiatric illnesses.

RESULTS

Among the study cases, out of a total of 80 patients, there were 54 (67.50%) males and 26 (32.50%). There was an overall male preponderance, with the M: F ratio being 1:0.48. The gender distribution of cases in Group C and Group D was found to be comparable with no statistically significant difference (p=0.8116) (Table 1).

The most common age group of the patients in group C was found to be 31–40 years (70%), followed by 18–30 years (17.50%). In group D, the most commonly affected age group was 31–40 (60%), followed by 18–30 years (22.50%). The mean age of patients in group C was 38.36±12.42 years, whereas the mean age of patients in group D was found to be 40.01±13.24 years. The mean age of patients in both groups was found to be comparable, with no statistically significant difference (p=0.5671) (Table 2).

The most common types of surgeries in the studied cases were those of lower radius and ulna (28.75%), followed by the lower humerus (21.25%), upper radius and ulna (20%), hand surgeries (16.25%), and midshaft of radius and ulna (13.75%) (Fig. 1).

Both groups were compared for the onset of sensory and motor blocks. The mean sensory block in groups C and D was found to be 4.38±1.26 min and 3.92±1.18 min, respectively. The mean onset of motor block in groups C and D was found to be 6.28±1.92 min and 6.86±2.10 min, respectively. The mean time for the onset of sensory as well as motor block was found to be comparable in both studies. The duration of sensory block in groups C and D was found to be 328.40±52.86 min and 512.68±62.10 min, respectively. The duration of motor blocks in groups C and D was found to be 386.64±48.68 min and 568.62±46.64 min, respectively. The duration of analgesia in groups C and D was found to be 352.20±46.12 min and 532.46±50.36 min, respectively. The mean duration of sensory as well as motor block and

Table 1: Gender distribution of studied cases

Gender	Males		Females	
	No of cases	Percentage	No of cases	Percentage
Group C	28	35.00	12	15.00
Group D	26	32.50	14	17.50
Total	54	67.50	26	32.50

p=0.8116 (Not significant)

Table 2: Comparison of age distribution of the studied cases

Age in years	Group C		Group D	
	No of cases	Percent	No of cases	Percent
18-30	7	17.50	9	22.50
31–40	28	70.00	24	60.00
41–50	3	7.50	6	15.00
>50 years	2	5.00	1	2.50
Total	40	100.00	40	100.00
Mean Age:	38.36±12.42 years		40.01±13.24	

p=0.5671 (Not significant)

duration of analgesia was found to be higher in group D as compared to group C, and the difference was found to be statistically significant (p<0.0001) (Table 3).

The hemodynamic parameters such as heart rate, respiratory rate, SBP, diastolic BPs (DBP), and SpO_2 were compared in both groups until 12 h post-operatively. Though the mean heart rate and SBP were found to be lower in group D as compared to group C between 60 and 90 min, the difference was not found to be statistically significant (p>0.05) (Figs. 2-4).

The comparison of the quality of anesthesia in both groups showed that it was better in patients who received dexmedetomidine as compared to those who received clonidine as an adjuvant with bupivacaine, and the difference was statistically significant (P =0.001) (Table 4).

No significant side effects were seen in any of the groups. The transient hypotension and bradycardia seen in some cases in Group D reverted without any interventions.

DISCUSSION

In this comparative study of 80 patients undergoing upper limb surgeries under brachial plexus blocks, the patients were divided into two groups depending on whether they received dexmedetomidine or clonidine as adjuvants to bupivacaine. The mean age and gender distribution of both groups were found to be comparable. The most common types of surgeries in the studied cases were those of the lower radius and ulna (28.75%), followed by the lower humerus (21.25%), upper radius and ulna (20%), hand surgeries (16.25%), and midshaft of radius and ulna (13.75%).

The mean sensory block in groups C and D was found to be 4.38±1.26 min and 3.92±1.18 min, respectively. The mean onset of motor block in groups C and D was found to be 6.28±1.92 min and 6.86±2.10 min, respectively. The mean time for the onset of sensory as well as motor block was found to be comparable in both studies.

Table 3: Comparison of block characteristics in both the groups

Block characteristics	Group C	Group D	p-value
Onset of block (in minutes)			
Sensory	4.38±1.26	3.92±1.18	0.095
Motor	6.28±1.92	6.86±2.10	0.201
Duration of block			
Sensory	328.40±52.86	512.68±62.10	p<0.0001*
Motor	386.64±48.68	568.62±46.64	p<0.0001*
Duration of analgesia	352.20±46.12	532. 46±50.36	p<0.0001*

*Significant

Table 4: Comparison of quality of anesthesia in both the groups

Grade	Group C		Group D	
	No of cases	Percentage	No of cases	Percentage
1	18	45.00	33	82.50
2	22	55.00	7	17.50
3	0	0.00	0	0.00
4	0	0.00	0	0.00

p=0.001 (Significant)

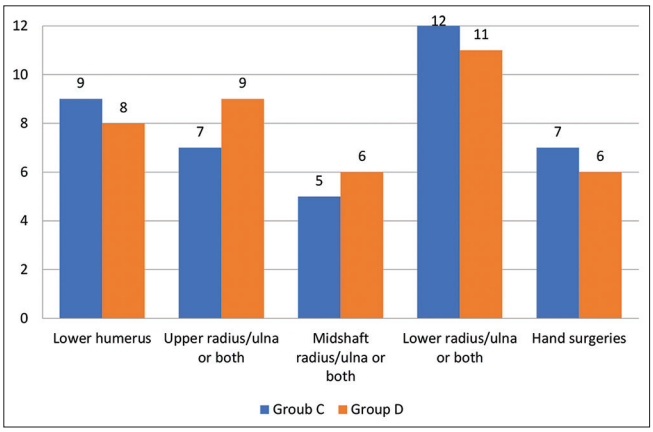

Fig. 1: Types of surgeries in studied cases

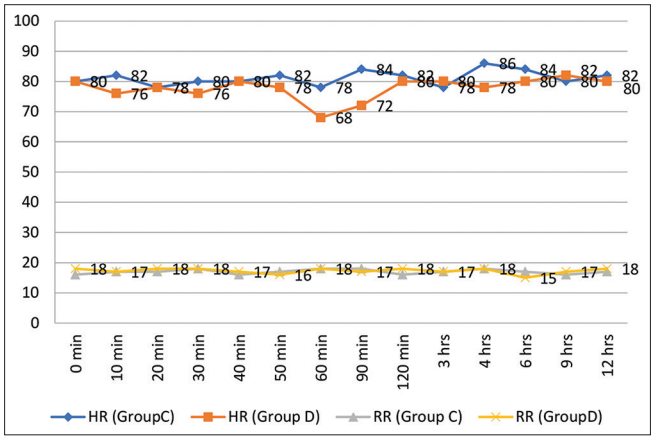

Fig. 2: Comparison of heart rate and respiratory rate in studied cases

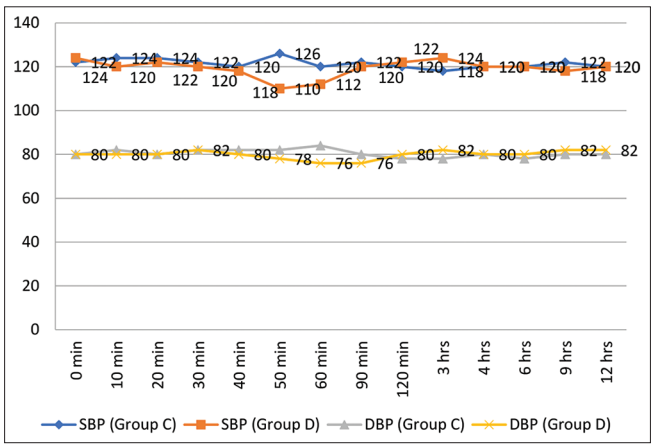

Fig. 3: Comparison of systolic blood pressure and diastolic blood pressure in studied cases

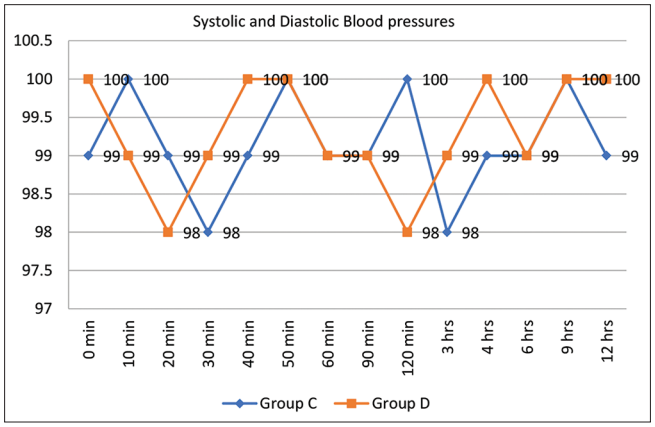

Fig. 4: Comparison of SpO_2 in studied cases

Tripathi *et al*. conducted a comparative study of the effects of clonidine and dexmedetomidine as adjuncts to bupivacaine in the supraclavicular brachial plexus and compared the onset and duration of sensory and motor block and the duration of analgesia [12]. The authors found the onset of sensory blockade to be 4.53±1.38 and 3.97±1.27 min in the clonidine and dexmedetomidine groups, respectively. The mean time for the onset of sensory blockade was found to be comparable in both groups. A similar onset of motor blockade was also found to be comparable in both groups (5.97±1.77 vs. 6.47±1.43 min). Similar findings were also reported by the authors, such as Bajpai *et al*. [13] and Brummett *et al*. [14].

In our study, the duration of sensory block in groups C and D was found to be 328.40±52.86 min and 512.68±62.10 min, respectively. The total duration of motor blocks in groups C and D was found to be 386.64±48.68 min and 568.62±46.64 min, respectively. The duration of analgesia was found to be higher in group D as compared to group C, and the difference was found to be statistically highly significant ($p<0.0001$). Kataria *et al*. conducted a study for comparison of dexmedetomidine and clonidine as adjuvants to levobupivacaine in supraclavicular brachial plexus block [15]. The study found that the mean duration of sensory block in Group A (clonidine) was 11.90±0.81 h and in Group B (dexmedetomidine) was 14.93±0.89 h, whereas the mean duration of motor block in Group A was 14.131±0.806 h and in Group B was 17.831±0.775 h. Group B showed a longer duration of sensory and motor block, and the difference between the two groups was found to be statistically significant ($p<0.001$). Similar findings were also reported by the authors, such as Chaudhary *et al*. [16] and Ganga *et al*. [17].

Analysis of hemodynamic parameters such as heart rate, respiratory rate, SBP, DBP, and SpO_2 were found to be comparable in both groups. The quality of anesthesia was better in patients who received dexmedetomidine as compared to those who received clonidine as an adjuvant with Bupivacaine, and the difference was statistically significant ($p=0.001$). In a similar study, Swami *et al*. reported that in the dexmedetomidine group, 80% of the patients achieved Grade IV quality of block as opposed to 40% in the clonidine group ($p<0.05$) [18]. The study found that in the dexmedetomidine group, the quality of anesthesia was better than in the clonidine group, and the difference was statistically significant ($p=0.015$). Similar findings were also reported by the authors, such as Sebastian *et al*. [19] and Rao *et al*. [20].

CONCLUSION

Dexmedetomidine used as an adjuvant with bupivacaine in brachial plexus block in upper limb surgeries is associated with prolonged duration of sensory and motor block, along with the duration of analgesia, as compared to when clonidine is used as an adjuvant. It is also associated with a better quality of anesthesia as compared to clonidine. However, both clonidine and dexmedetomidine showed similar hemodynamic and side effect profiles.

CONFLICT OF INTEREST

None.

REFERENCES

1. Neal JM, Gerancher JC, Hebl JR, Ilfeld BM, McCartney CJ, Franco CD, *et al*. Upper extremity regional anaesthesia: Essentials of our current understanding, 2008 [published correction appears in Reg Anesth Pain Med. 2010 Jul-Aug;35(4):407]. Reg Anesth Pain Med 2009;34:134-70. doi:10.1097/AAP.0b013e31819624eb
2. D'Souza RS, Johnson RL. Supraclavicular block. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2023.
3. Omoregbe OR, Idehen HO, Imarengiaye CO. Supraclavicular brachial plexus block for upper limb fracture fixation: A comparison of nerve stimulation, ultrasound-guided technique and a combination of both techniques. West Afr J Med 2020;37:757-62.
4. Kapral S, Krafft P, Eibenberger K, Fitzgerald R, Gosch M, Weinstabl C. Ultrasound-guided supraclavicular approach for regional anaesthesia of the brachial plexus. Anesth Analg 1994;78:507-13. doi:10.1213/00000539-199403000-00016
5. Aksu R, Bicer C. Addition of dexmedetomidine to bupivacaine in supraclavicular brachial plexus block. Clin Invest Med 2017;40:E111-6. doi:10.25011/cim.v40i3.28390
6. Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anaesthetics: Current understanding and future trends. World J Clin Cases 2017;5:307-23. doi:10.12998/wjcc.v5.i8.307
7. Popping DM, Elia N, Marret E, Wenk M, Tramèr MR. Clonidine as an adjuvant to local anaesthetics for peripheral nerve and plexus blocks: A meta-analysis of randomized trials. Anesthesiology 2009;111:406-15. doi:10.1097/ALN.0b013e3181aae897
8. McCartney CJ, Duggan E, Apatu E. Should we add clonidine to local anaesthetic for peripheral nerve blockade? A qualitative systematic review of the literature. Reg Anesth Pain Med 2007;32:330-8. doi:10.1016/j.rapm.2007.02.010
9. Singh AP, Mahindra M, Gupta R, Bajwa SJ. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anaesthetic approach. Anesth Essays Res 2016;10:414-9. doi:10.4103/0259-1162.176404
10. Kumari P, Singh RB, Saurabh K, Pal S, Ram GK, Anand RK. To compare the efficacy of postoperative analgesia between clonidine and dexmedetomidine as adjuvants with 0.5% ropivacaine by ultrasound-guided supraclavicular brachial plexus block for upper limb surgeries: A prospective, double-blind, randomized study. Anesth Essays Res 2020;14:644-52. doi:10.4103/aer.aer_57_21
11. Schubert AK, Seneviratne V, Stolz J, Wiesmann T, Wulf H, Eberhart L, *et al*. The effect of adjuvants added to local anaesthetics for single-injection upper extremity peripheral regional anaesthesia: A systematic review with network meta-analysis of randomised trials. Eur J Anaesthesiol 2023;40:672-90. doi:10.1097/EJA.0000000000001860
12. Tripathi A, Sharma K, Somvanshi M, Samal RL. A comparative study of clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol 2016;32:344-8. doi:10.4103/0970-9185.188819
13. Bajpai V, Patel TK, Dwivedi P, Bajpai A, Gupta A, Gangwar P, *et al*. Dexmedetomidine versus clonidine as an adjuvant to local anaesthetic in brachial plexus blocks: A meta-analysis of randomised controlled trials. Braz J Anesthesiol 2023;73:665-75. doi:10.1016/j.bjane.2022.07.005
14. 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. doi:10.1097/ALN.0b013e318182c26b
15. Kataria AP, Jarewal V, Singh G, Attri JP. Comparison of dexmedetomidine and clonidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block. Int J Med Res Rev 2017;5:399-404. doi:10.17511/ijmrr.2017.i04.05
16. Chaudhary UK, Danesh A, Mahajan M, Kumar S, Verma V, Awasthi B. Comparison of effects of dexmedetomidine and clonidine as adjuvant to bupivacaine 0.25% in ultrasound guided supraclavicular brachial plexus block. Int J Res Med Sci 2017;5:4512-8.
17. Ganga G, Amrutha K, Joseph T. Dexmedetomidine v/s clonidine as adjuvants to bupivacaine in supraclavicular brachial plexus block. Int J Health Sci 2022;6:944-95.
18. Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine ($\alpha 2$ agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian J Anaesth 2012;56:243-9. doi:10.4103/0019-5049.98767
19. Sebastian D, Ravi M, Dinesh K, Somasekharam P. Comparision of dexmedetomidine and clonidine as adjuvant to ropivacaine in supraclavicular brachialplexus nerve blocks. J Dent Med Sci 2015;14:91-7. doi: 10.9790/0853-14359197
20. Rao KG, Kapoor P, Chaurasiya MK, Shukla A. A randomized double blind prospective study to compare coinidine and dexmedetomidine as an adjuvant in supra-clavicular brachial block. Indian J Fundam Appl Life Sci 2014;4:226-9.