IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 21, Issue 1 Ser.17 (January. 2022), PP 14-20
www.iosrjournals.org

Comparison of two different doses of Dexmedetomidine to 0.5% Levobupivacaine in supra clavicular brachial plexus block

Zareena Shaik [1], S.Vinay Kumar[2] ,S. Harika[3] , A.Venkateswara Rao[4] .
1st Author- Assistant professor Dept of Anesthesiology, Siddhartha medical college, Vijayawada.
2n d- Corresponding Author- Associate Professor, Dept of Anesthesiology Siddhartha Medical college, Vijayawada.
3rd Author – Senior Resident Dept of Anesthesiology, Siddhartha medical college, Vijayawada.
4th Author- Professor, Dept of Anesthesiology, Siddhartha medical college, Vijayawada.

Abstract

Introduction*: Regional anesthesia with PNBs is a cornerstone of multimodal analgesia and opioid-sparing strategies. At present, there is an interest in performing the blocks with peripheral nerve stimulators as it increases the success rate considerably. PNB with local anesthetics is combined with adjuvant drugs to achieve prolonged analgesia, reduce local anesthetic dose to avoid toxicity, and potentially reduce motor blockade.*
Aim: *The study aims to assess the duration of analgesia of two different doses of Dexmedetomidine,50mcg and 100mcg added to 0.5% Levobupivacaine to brachial plexus block through the supraclavicular approach using a peripheral nerve stimulator.*
Materials and Methods: *After ethics committee approval and informed consent 60 patients aged 18-60 yrs of either sex with ASA physical status class I and II scheduled for upper limb surgeries were randomly allocated into two groups and brachial plexus was blocked by PNS guided supraclavicular approach. 1.GROUP D50 (n=30) received 29 ml of 0.5% Levobupivacaine + Dexmedetomidine 50mcg (+0.5cc normal saline added)and 2.GROUP D100(n=30): 29 ml of 0.5% Levobupivacaine + Dexmedetomidine 100 Mcg(1cc). It was a double blinded study and both the groups were compared and assessed in terms of onset of sensory and motor block, duration of analgesia and time for rescue analgesia.* ***Results****: There was a statistically significant decrease in onset of sensory and motor block with increased duration of analgesia and increase in time for rescue analgesia for the group with Dexmedetomidine 100mcg as adjuvant to Levobupivacaine.*
Conclusion: *Higher concentration (100mcg) of dexmedetomidine was more effective in terms of achieving faster onset and longer duration of analgesia.*

Key Words: *Peripheral nerve stimulator, supraclavicular block, levobupivacaine, dexmedetomidine.*

Date of Submission: 16-01-2022 Date of Acceptance: 31-01-2022

---

i. Introduction

Peripheral nerve blocks provide good operating conditions, postoperative analgesia, and a diagnostic, therapeutic role in acute and chronic pain management. Compared to general anaesthesia peripheral nerve blocks cause less interference with the physiology of the human body, less stress response, and avoids the use of many drugs and their related complications. The basis for the use of peripheral nerve blocks is to interrupt nociceptive impulses coursing in the peripheral nerves. Regional anaesthesia with PNBs is a cornerstone of multimodal analgesia and opioid-sparing strategies. The supraclavicular block is one of many techniques used to anesthetize the brachial plexus. The entire sensory, motor and sympathetic innervations of the upper extremity are carried in just three nerve structures confined to a tiny surface area. PNB with local anaesthetics is combined with adjuvant drugs to achieve prolonged analgesia, reduce local anaesthetic dose to avoid toxicity, and potentially reduce motor blockade.

Adding additives to local anaesthetics in peripheral nerve blocks helps to fasten the onset of action, prolong the duration of action, and improve blockade quality. Various additives are added to local anaesthetics. In present study, Dexmedetomidine, that belongs to the group of α2 agonists, is used as an adjuvant to potentiate local anaesthetic's action. Since Dexmedetomidine has an α2:α1 selectivity ratio of 1620:1 it lessens the unwanted side effect of α1 and has much more sedative and analgesic action. This study is done to compare the effect of two different doses of Dexmedetomidine when added to Levobupivacaine in the brachial plexus block.

AIM OF THE STUDY

To assess the duration of analgesia of two different doses of Dexmedetomidine,50 mcg and 100mcg added to 0.5% Levobupivacaine to brachial plexus block through the supraclavicular approach.

OBJECTIVES OF THE STUDY To compare the duration of analgesia with Dexmedetomidine 50 and 100mcg as an adjuvant to 0.5% Levobupivacaine in terms of

1. Onset time of sensory blockade.
2. Onset time of motor blockade.
3. Duration of sensory blockade.
4. Duration of motor blockade.
5. Duration of analgesia.
6. Time of rescue analgesia.
7. Untoward side effects.

METHODS AND MATERIALS: Study conducted in 60 patients aged between 18 and 60 years of physical status ASA 1 and 2 undergoing orthopaedic, plastic, reconstructive surgeries of duration more than 30 minutes were included in the study. The study was conducted at GGH, Vijayawada, which was attached to Siddhartha Medical College, Vijayawada.

Type of study: Prospective randomized double blinded.

INCLUSION CRITERIA: Patients between 18 and 60 years, under physical status ASA 1 and ASA 2 scheduled for upper limb surgeries were included after obtaining ethical clearance from the Institution and informed written consent from the patients.

EXCLUSION CRITERIA: Patients with cardiovascular diseases (ischemic heart disease, hypertension, valvular heart disease), neuromuscular diseases, thyroid diseases, diabetes mellitus, hepatic or renal failure, patient refusal, Patients on adrenoreceptor agonist or antagonist therapy, known sensitivity to local anaesthetics, pregnant and lactating females, drug abusers and psychiatric patients, patients with ASA grade 3 and 4 are excluded from the study.

METHOD OF COLLECTION OF DATA

The randomization was done by a computerized program, and patients were allocated into two groups:
GROUPD50(n=30) and
GROUPD100(n=30)in a double blind fashion.
All the patients were premedicated with Intravenous Injection Midazolam 2 mg, 15 minutes before the block.

• GROUP D50 (n=30) received 29 ml of 0.5% Levobupivacaine + Dexmedetomidine 50mcg (+0.5cc normal saline added)

• GROUP D100(n=30) : 29 ml of 0.5% Levobupivacaine + Dexmedetomidine 100mcg(1cc). The total volume of the drug given to each patient is 30ml.

PROCEDURE: After shifting the patient to the operation room, non invasive minimum mandatory monitors were attached and the baseline pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, ECG (lead II), and oxygen saturation were noted down. A wide bore IV cannula was secured, and an infusion of Normal Saline was started at a rate of 10ml/kg body weight. After patient positioning and skin disinfection supraclavicular block was performed using a peripheral nerve locator. An evident motor twitch of all fingers even at 0.5 mA current, was taken as an end motor response and the drug was injected with a repeated aspiration for blood and air. Care was taken to avoid needle displacement, to prevent vascular and pleural puncture. Immediately after drug injection, gentle massage was done over the point of drug injection for even distribution of the drug.

The following parameters were observed:

1. **Onset time of the sensory blockade**: Sensory block in the ulnar nerve, median nerve, radial nerve, the musculocutaneous nerve was assessed by using a 3-point scale: 0 = normal sensation, one = loss of pinprick (analgesia), and two = loss of touch (anaesthesia)

2. **Onset time of the motor blockade:** Motor block assessed by the action of the four nerves on movements of thumb by abduction (radial nerve), adduction (ulnar nerve), opposition (median nerve), and flexion at the elbow joint (musculocutaneous nerve) according to the modified Bromage scale on a 3- point scale:

0:Normal muscle power with full flexion and extension of elbow, wrist, and fingers
1:Decreased motor power with the ability to move the fingers only
2:Complete motor block with the inability to move the fingers. The onset of motor blockade was considered when there was decreased muscle power. Peak motor block was considered when the patient was unable to move the fingers. The sensory and motor blocks were assessed and time taken for recovery of sensory and motor functions were noted.

3. **Duration of sensory blockade:** It is defined as the time interval from onset of paraesthesia to return of normal sensation on all the nerves (score 0).
4**. Duration of analgesia.** It is defined as the time between the onset of action and the onset of pain. (VAS1)
5. **Duration of motor block:** It was taken as the time interval from complete motor block to complete recovery of the power of muscles of hand and forearm. During surgery, heart rate, noninvasive blood pressure, and peripheral oxygen saturation were monitored. Symptoms such as nausea, vomiting, sedation, and other adverse effects were observed.
6.**Time for rescue analgesia**: It is defined as the time after the block at which the patient complained of pain and requested for supplementation of analgesia, and the VAS score was more than 5. In the postoperative period, patients were visited first at 30 and 60 minutes, then every hourly till 6 hours, then every 2ndhourly till 12 hours, then at 18 and 24 hours. The postoperative analgesia was assessed using 10 points visual analog scale (VAS), which is the most commonly used method of assessing the intensity of acute pain and its relief. VAS is a 10 cm long scale with graduation at every 1 cm. from 0 to 10. Score 0 on this scale denotes no pain, while a score of 10 denotes the most excruciating pain one can have.The patients were explained about this scoring system and were asked to make a vertical mark on the scale, reflecting the intensity of pain they experienced at that time. The rescue analgesia was given when the VAS score was noted as 5 or more Inj. Tramadol 100mg diluted in 10 ml normal saline slow iv was given .
Sedation was monitored and graded using Ramsay sedation score
1. Anxious, agitated or restless, or both
2. Cooperative, oriented, and tranquil.
3. Responds to commands only
4. Brisk response to a glabellar tap or auditory stimulus
5. Sluggish response to a light glabellar (forehead) tap or loud sound stimulus
6. No response.
All the patients were observed for any side effects and complications like hypotension, bradycardia, respiratory depression, nausea, vomiting, allergic reactions, pneumothorax, local hematoma formation and any neurological sequel in the intra and postoperative period.

Statistical analysis:
Data were entered in MS-Excel and analysed in SPSS V22.
 Descriptive statistics were represented with percentages.
 Mean with SD.
Chi-square test, Independent t-test were applied to find significance.
A p-value of less than 0.05 was considered as statistically significant.
The mean age in GROUP D50 is 36.70 ± 15.30 years, and that of GROUP D100 is 41.40±15.32 years. The P-value is 0.23. Hence there is no statistically significant difference regarding age, and both the groups are comparable regarding age distribution. There is no statistically significant difference in sex distribution, height and weight and both groups are comparable .

	SOT		**MOT**		**DOSB**		**DOMB**		**DOA**		**TORA**	
GROUPS	**D50**	**D100**	**D50**	**D100**	**D50**	**D100**	**D50**	**D100**	**D50**	**D100**	**D50**	**D100**
MEAN	14.83	10.50	19.50	15.20	762.67	992.33	733.67	945.33	790.00	1017.67	823.00	1053.33
SD	2.38	1.12	3.25	1.52	78.56	67.95	81.18	59.99	78.26	65.74	74.66	68.20
SE MEAN	0.43	0.20	0.59	0.28	14.34	67.96	14.82	10.95	14.29	12.00	13.63	12.45
T -test	9.04		6.57		6.57		-11.48		-12.20		-12.47	
P-value	**0.001**		**0.001**		**0.001**		**0.001**		**0.001**		**0.001**	

TABLE 1: showing measured parameters in both the groups with P value.

From the above findings the onset of the sensory and motor blockade (as taken as point 1 on the modified Bromage scale) were faster in D100 group, the duration of sensory blockade, i.e., time till the return of sensation, the duration of motor blockade, i.e., from the onset of the block to return of complete motor power, the duration of analgesia, i.e., time from onset of analgesia till the patient can first feel the pain- VAS 1 and the time till which the patients complains of pain and asks for analgesic, i.e., VAS > 5 were all greater in D100 group than compared to D50 group. All the above findings were statistically highly significant.

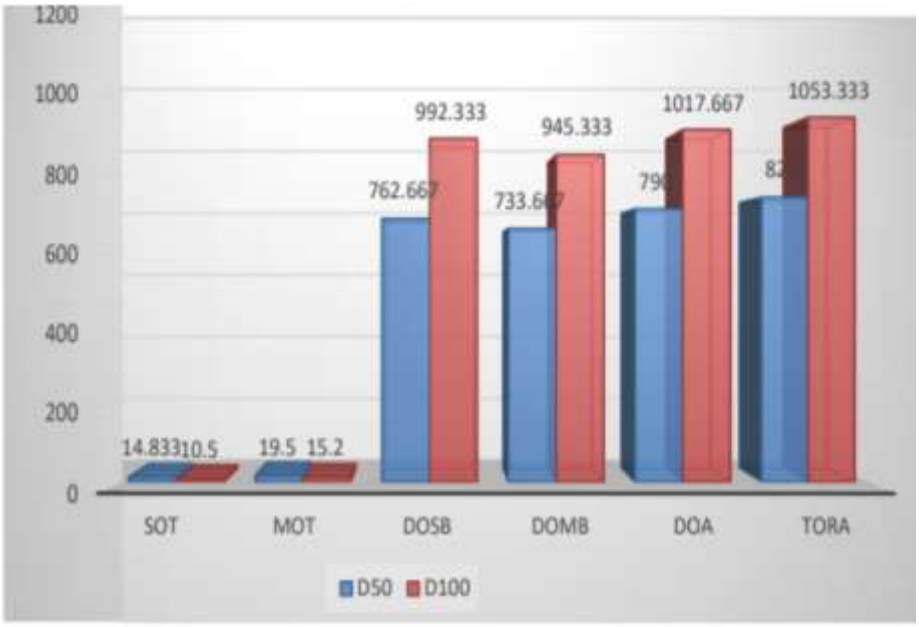
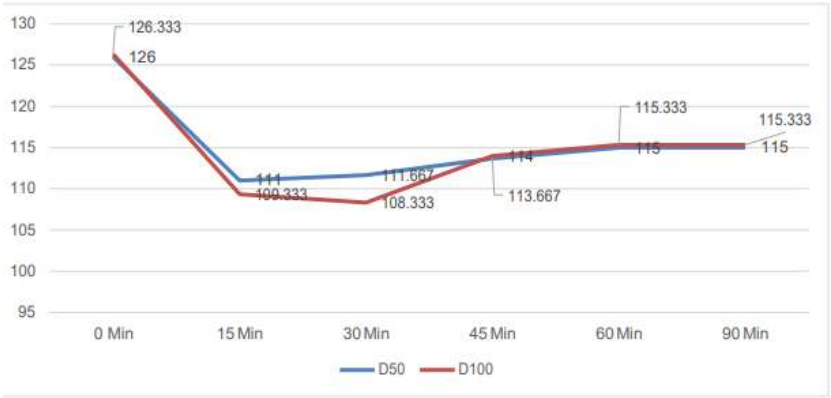
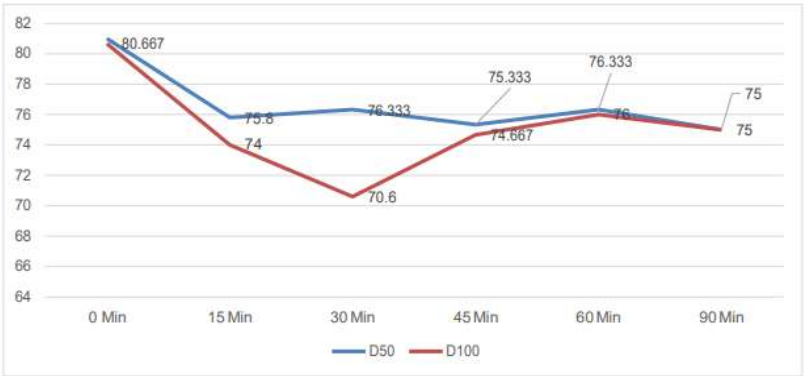


CHART 1: BAR CHART SHOWING THE MEASURED PARAMETERS.

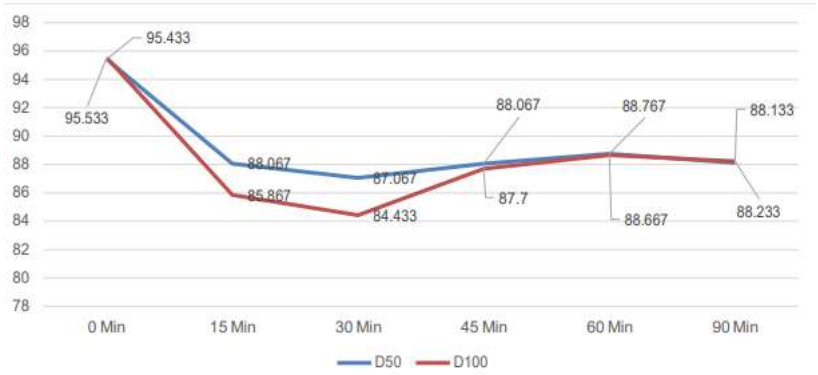
Hemodynamics



LINE DIAGRAM SHOWING SYSTOLIC BLOOD PRESSURE

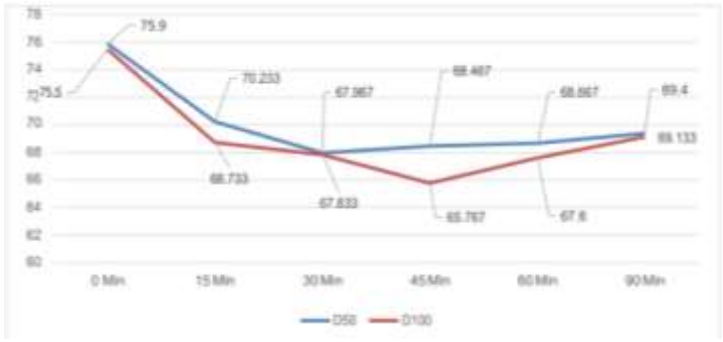


LINE DIAGRAM SHOWING DIASTOLIC BLOOD PRESSURE



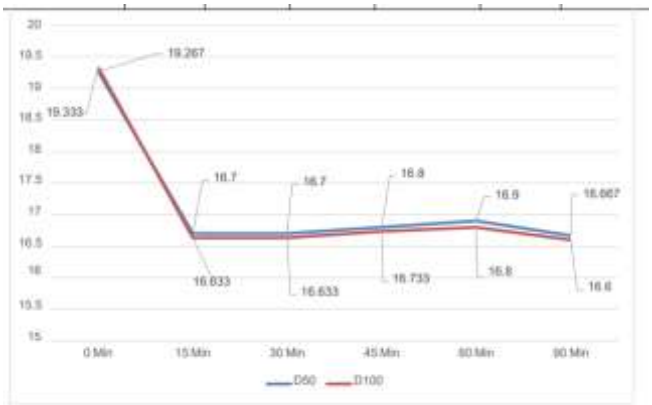
LINE DIAGRAM SHOWING MEAN ARTERIAL BLOOD PRESSURE

The above graphs show the Systolic Blood Pressure, Diastolic Blood Pressure, and Mean Arterial Pressure of the patients. Hypotension was defined as statistically significant if the P< 0.05 or the blood pressure was less than 20% from the baseline. Hypotension was treated with 6 mg aliquots of injection Mephentermine and 200 ml fluid bolus. It was observed that a decrease in blood pressure was noted (in 15th minute) in both groups but more in the D100 group but was not statistically significant.

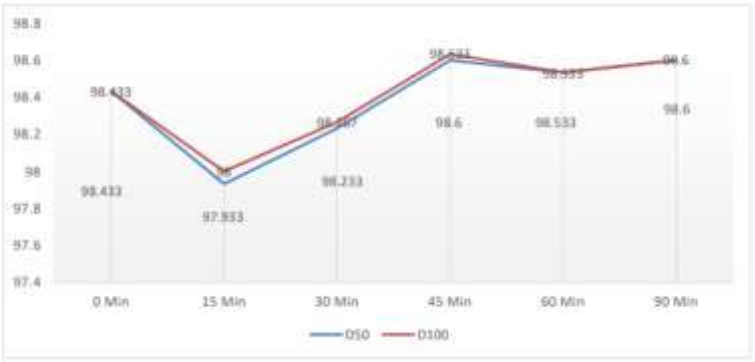


LINE DIAGRAM SHOWING HEART RATE.

The above shows the pulse rate of patients throughout the procedure. Bradycardia was defined as heart rate less than 60 bpm or 20% less than that of the baseline heart rate. Bradycardia was treated with 0.6 mg of Inj. Atropine sulphate. In present study, there was bradycardia in both groups after 15 mins but more with the D 100 group. Bradycardia was treated with 0.6 mg of inj. Atropine sulphate once and event never occurred again. But there was no statistically significant reduction in heart rate upon addition of 100 µg of Dexmedetomidine to Levobupivacaine for supraclavicular brachial plexus block.



LINE DIAGRAM SHOWING RESPIRATORY RATE



LINE DIAGRAM SHOWING SPO_2

The above shows the respiratory rate and oxygen saturation observed throughout the study. There was no statistically significant reduction of respiratory rate and oxygen saturation in the D50 and D100 groups. Therefore, it can be said that the addition of 100 µg of Dexmedetomidine to Levobupivacaine for supraclavicular brachial plexus block would not cause any respiratory depression.

RAMSAY SEDATION SCORE

Group	Mean	SD	SE Mean
D50	2.167	0.3790	0.0692
D100	3.100	1.0619	0.1939

T test 4.53 P-Value 0.001

The above table shows the sedation, which was calculated by a 6 point Ramsay sedation score. There was increased sedation in the D100 group when compared to the D50 group. The p-value is 0.001. It was statistically significant but the patients were not profoundly sedated. They were arousable on verbal commands and touch.

II. Discussion

Dexmedetomidine is currently in focus for its sedative, anxiolytic, and analgesic properties. Pre- and intra- operative intravenous Dexmedetomidine administration has shown to prolong the duration of sensory block with local anaesthetics during peripheral nerve blocks. Animal studies have shown that Dexmedetomidine enhances the onset of sensory and motor blockade along with the increased duration of analgesia. In human beings it is shown to prolong the duration of block and postoperative analgesia when added to local anaesthetics in various regional blocks. The benefits of adding Dexmedetomidine to local anaesthetics during regional anaesthesia and some peripheral nerve blockade procedures have been proven to be efficacious.

The mechanism of the analgesic actions of α2 agonists has not been fully understood and is probably multifactorial. Several supraspinal and spinal sites cause modulation of the transmission of nociceptive signals in the CNS. Peripheral α2 adrenoceptors may also mediate the antinociception. In the context of perineural adjuvants, the efficacy of Dexmedetomidine, when administered peripherally, appears to be comparable with Dexamethasone and exceeds that of Clonidine, and Magnesium. present study observations were comparable with Agarwal Setal[1]in their study there was earlier onset of both sensory and motor block with 100µg Dexmedetomidine. It may be concluded that the onset of sensory & motor blockade was earlier as the dose increases. In present study, the duration of sensory block was longest with Group D100 (sensory mean 992.33±67.9minutes), compared with Group D50 (sensory mean 762.67±78.56 minutes) and motor block was longest with Group D100 (motor mean 945.33± 59.984minutes) compared with Group D50 (motor mean 733.66 ± 81.17 minutes). These observations are comparable with previous studies of Yuzhang et al.[2] and Agarwal S et al[1] who observed that onset and duration of both sensory and motor block significantly differed between groups. Esmaoglu et al.[3] concluded that Dexmedetomidine (100µg) when used as an additive to 40 ml of 0.5% Levobupivacaine in axillary brachial plexus block showed that Dexmedetomidine not only shortened the sensory and motor block onset time but also prolonged both sensory and motor block duration too. Zhang et al[2]. found that the addition of 100 µg of Dexmedetomidine to Ropivacaine produced a prolonged duration of motor block compared to the Ropivacaine alone group but concurrently increased the incidence of hypotension and bradycardia. Keplinger et al.[4]. assessed the dose-dependency of Dexmedetomidine when added to Ropivacaine for peripheral nerve blockade and found a significant dose dependent increase in the mean duration (SD) of analgesia with increasing doses of Dexmedetomidine:

In the present study, time for rescue analgesia is 823 ± 74.65 min in GROUP D 50, and it is 1053.33±68.19 min GROUP D100. The requirement of rescue analgesia was earlier in GROUP D 50. The analgesic effect of Levobupivacaine in supraclavicular brachial plexus block was potentiated in a dose dependent manner by adjuvant Dexmedetomidine. In present study, fewer patients in the Group D100 group required Tramadol injection as rescue analgesia ($P < 0.05$). This finding correlates with the studies of Kaygusuz et al[5] and Swami et al [6] .

In the present study sedation was also dose-dependent, with Group D100 (3.10 ± 1.06) achieving more sedation than Group D50 (2.16± 0.37) thereby correlating to the studies of Bharti etal[7]and Keplinger et al[4.] In respect of complications, bradycardia and hypotension were the only adverse effects noted and were much associated with the Group D100. But the association with Group D50 did not have any statistical significance($P>0.05$). There was only one incidence of Bradycardia requiring only one dose of 0.6 mg inj. Atropine sulphate with no further recurrence in all. Hypotension was treated with 200 ml bolus of crystalloids (ringer lactate/normal saline) and inj.Mephentermine 6 mg IV with no further decrement. The incidence of hypotension was statistically not significant between the groups. However, these adverse effects can be managed easily.

Sedative properties of Dexmedetomidine are attributable to its lipophilic nature resulting in systemic absorption and central action by inhibition of substance P at the level of dorsal root neuron and activation of α2 adrenoreceptors in locus coeruleus. Nasir Hussain et al[9] a systematic review and meta-analysis of 18 randomized controlled trials showed that addition of Dexmedetomidine to local anaesthetics was found to significantly improve analgesia in all 18 included studies. However, patients receiving Dexmedetomidine should be continuously monitored for intraoperative bradycardia.

III. Conclusion

The present study comparing anaesthetic and analgesic effects of adding alpha-2 agonist Dexmedetomidine in two concentrations into brachial plexus sheath with 0.5% Levobupivacaine solution in patients undergoing upper extremity orthopaedic, plastic or reconstructive surgeries showed statistically significant decrease in onset and increase in duration of analgesia in terms of both sensory and motor block with higher concentration. However continuous vigilant monitoring for potentially harmful but reversible adverse effects is mandated.

References

[1]. Agarwal S, Aggarwal R, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. JAnaesthesiolClinPharmacol2014;30:36-40.
[2]. Yu Zhang et al, Perineural administration of dexmedetomidine in combination with ropivacaine prolongs axillary brachial plexus block, Int J ClinExp Med 2014;7(3):680 685.
[3]. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. AnesthAnalg2010;111:1548-51.
[4]. Keplinger M, Marhofer P, Kettner SC, Marhofer D, Kimberger O, Zeitlinger M. A pharmacodynamic evaluation of dexmedetomidine as an additive drug to ropivacaine for peripheral nerve blockade: A randomised, triple-blind,controlled study in volunteers. Eur J Anaesthesiology2015;32:790-6.
[5]. Kaygusuz K, Kol I O ,Duger C, Gursoy S, Ozturk H, Kayacan U, AydinR, Mimaroglu R .Effects of Adding Dexmedetomidine to Levobupivacaine in Axillary Brachial Plexus Block; Current Therapeutic Research2012;73(3): 103-111.
[6]. Swami SS, Keniya VM, Ladi SD, Rao R ;Indian J Anaesth.; 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; 2012 May;56(3):
[7]. Bharti N, Praveen R, Bala I. A dose-response study of caudal dexmedetomidine with ropivacaine in pediatric day care patients undergoing lower abdominal and perinealsurgeries: A randomized controlled trial. PaediatrAnaesth2014;24:1158-63.
[8]. Popping DM, Elina N, Marret E, WenkE,Tramer MR, Clonidine as a adjuvant to local anaesthetic for peripheral nerve and plexus blocks:Ameta-analysis of randamized trail. Anesthesiology.2009;111:409-415.
[9]. Hussain N,Grzywacz VP, Ferreri CA, Atrey A, Banfield L, Shaparin N, Vydyanathan A. Investigating the Efficacy of Dexmedetomidine as an Adjuvant to Local Anesthesia in Brachial Plexus Block: A Systematic Review and Meta-Analysis of 18 Randomized Controlled Trials. Reg Anesth Pain Med. 2017 Mar/Apr;42(2):184-196.