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A Comparative Clinical Study of Two Different Doses of Dexmedetomidine Mixed as Adjuvant to Levobupivacaine 0.5% Solution for Giving Supra-Clavicular Brachial Plexus Block, in Patients Undergoing Upper Limb Surgeries

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Abstract: ***Background and Aims: Many studies have been conducted using dexmedetomidine as adjuvant to local anaesthetics in peripheral nerve blocks, but few studies compare the effect of different doses of dexmedetomidine. We aimed at comparing the clinical profile of different doses of dexmedetomidine as adjuvant to levobupivacaine in supraclavicular brachial plexus block and finding out the dose which provides maximum improvement in block parameters with minimum undesirable effects. Methods: After obtaining institutional ethical committee approval the study was started. 90 patients belonging to ASA I and II, undergoing elective upper limb surgery were randomly allocated into three groups of 30 each. Ultrasound guided Supraclavicular brachial plexus blocks were performed in each group. Group LC received plain levobupivacaine 0.5%, group LD50 and LD100 received 50mcg and 100mcg dexmedetomidine along with levobupivacaine 0.5% (100mg) respectively. Onset, duration of sensorimotor block, hemodynamic stability and adverse effects were assessed throughout the duration of surgery. Result: LD100 group showed statistically significant decrease in onset time and increase in duration of sensory and motor blockade compared to LD50 group and LC group (P = 0.001). We observed a decrease in mean heart rate with an increasing dose of dexmedetomidine. Incidence of bradycardia and mean sedation scores were more with group LD 100 than group LD 50 and LC. Conclusion: We conclude that dexmedetomidine when used in a dose of 50µg as adjuvant in peripheral nerve block, has the advantages of conscious sedation and hemodynamic stability in addition to significant improvement in block characteristics.***

Keywords: Dexmedetomidine, Ultrasound guided, Supraclavicular brachial plexus, Levobupivacaine 0.5%

1. Introduction

Regional blocks have become crucial in modern anaesthesia practice due to their ability to create optimal surgical conditions while minimizing systemic side effects.[1] Peripheral nerve blocks are frequently employed in upper limb surgery due to their ability to enhance postoperative pain management and minimize the risk of delirium or cognitive dysfunction.[2]The supraclavicular block is a regional anaesthetic technique used extensively as a substitute or addition to general anaesthesia, or for managing postoperative pain following upper extremity surgeries. Various combinations of local anaesthetics (LAs) and adjuvants, including tramadol, sufentanyl, clonidine, and fentanyl, have been used in the pursuit of finding the perfect agent, but it has proven to be a challenging task. [3-5] Therefore, this study was conducted to find the effect of addition of dexmedetomidine to levobupivacaine 0.5% to be used as local anaesthetic agent for giving anaesthesia (Supraclavicular brachial plexus block) in patients undergoing surgery of upper limb.

Aim and Objectives:
We aim to compare effect of two different doses of dexmedetomidine i.e. 50µg and 100µg to be mixed as adjuvant to fixed dose of levobupivacaine 0.5% (100mg).

Primary Objectives
- Onset and duration of sensory block.
- Onset and duration of motor block.

Secondary Objectives
- Hemodynamic changes
- Sedation and adverse effects.

2. Material and Methods

The study was conducted in Swaroop Rani Nehru Hospital associated with Moti Lal Nehru Medical College, Prayagraj after approval from Institutional Ethical Committee and obtaining written and informed consent from all patients.

After randomization and blinding, patients were divided into

three groups at random (using a sealed envelope procedure). The patients were put in a supine position and instructed to tilt their heads away from the neutral position along their bodies in preparation for the supraclavicular plexus block.

Skin above the clavicle was infiltrated with local anaesthetic, and then a 50 mm 22 G insulated short beveled stimulation needle (Stimuplex A, B. Braun Melsungen AG, Germany) was advanced toward the brachial plexus cluster under direct visualization using linear type ultrasonography probe (12 MHZ) in-plane technique, moving from lateral to medial.

A total of 21 mL of medication was administered to each of the three groups after the needle tip reached the brachial plexus cluster on the ultrasound image;
20 mL(100mg) of Levobupivacaine (0.5%) + 1 ml normal saline was given in Group LC,
20 mL(100mg) of Levobupivacaine (0.5%) + 50 µg (0.5 mL) dexmedetomidine as adjuvant+0.5ml Normal saline was given in Group LD50,
20 mL(100mg) of Levobupivacaine (0.5%) + 100 µg (1 mL) dexmedetomidine was given in Group LD100

3. Result

Table 1: Comparison of Onset of Sensory Block (in minutes) (N=90)

Parameters	Group LC (n=30)	Group LD 50 (n=30)	Group LD 100 (n=30)	F Value	P value
Onset of Sensory Block (in minutes)	16.40± 3.400	12.73± 2.545	7.33± 1.493	92.375	<0.00001

Table 1 shows the comparison of Onset of Sensory Block in the study groups. The mean duration of onset of sensory block in group LC was 16.40±3.400 min in group LD 50, 12.73±2.545 min, and 7.33±1.493 min in group LD 100, with all these differences being statistically significant (P<0.00001).

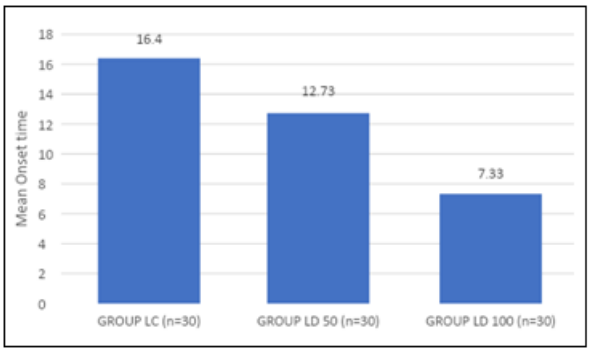

Figure 1: Comparison of Onset of Sensory Block (N=90)

Table 2: Comparison of Onset of Motor Block (in minutes) (N=90)

Parameters	Group LC (n=30)	Group LD 50 (n=30)	Group LD 100 (n=30)	F Value	P value
Onset of Motor Block (in minutes)	20.37± 2.748	16.33± 2.905	11.97± 2.553	70.586	<0.00001

Table 2 shows the comparison of Onset of Motor Block in the study groups. In our study, the mean duration of onset of motor block in group LC was 20.37± 2.748 min in group LD 50, 16.33± 2.905 min, and 11.97± 2.553 min in group LD 100, with all these differences being statistically significant (P<0.00001).

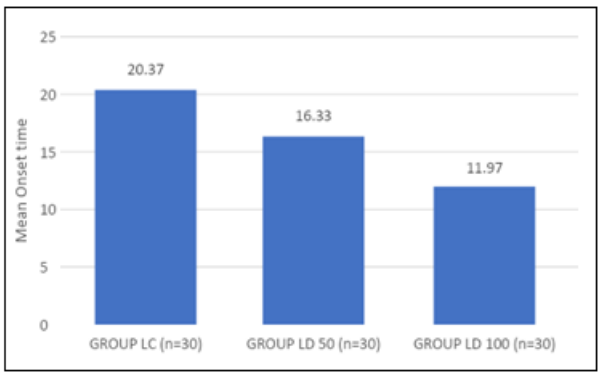

Figure 2: Comparison of Onset of Motor Block (in minutes) (N=90)

Table 3: Comparison of Duration of Sensory Block as per need for Rescue Analgesia (in minutes) (N=90)

Parameters	Group LC (n=30)	Group LD 50 (n=30)	Group LD 100 (n=30)	F Value	P value
Duration of Sensory Block (in minutes)	454.33± 80.801	671.00± 73.454	745.33± 64.687	127.711	<0.00001

The comparison of Duration of Sensory Block as per need for Rescue Analgesia in the study groups. In our study, the mean duration of sensory block as per need for Rescue Analgesia in group LC was 454.33± 80.801 min in group LD50, 671.00± 73.454 min, and 745.33± 64.687 min in group LD 100, with all these differences being statistically significant (P<0.00001).

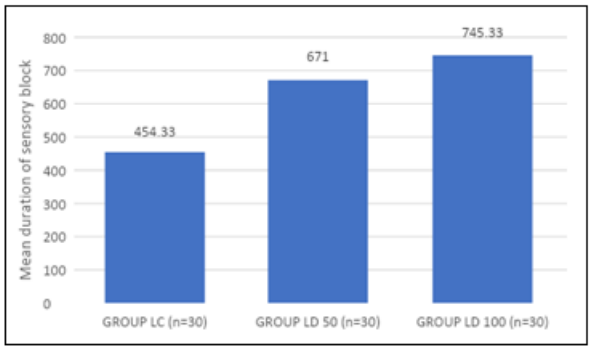

Figure 3: Comparison of Duration (in minutes) of Sensory Block as per need for Rescue Analgesia (N=90)

Table 4: Comparison of Duration of Motor Block (in minutes) (N=90)

Parameters	Group LC (n=30)	Group LD 50 (n=30)	Group LD 100 (n=30)	F Value	P value
Duration of Motor Block (in minutes)	418.33± 82.340	621.33± 88.424	701.33± 40.576	117.910	<0.00001

Table 4 shows the comparison of Duration of Motor Block in the study groups. In our study, the mean duration of motor block in group LC was 418.33± 82.340 min in group LD 50, 621.33± 88.424 min, and 701.33± 40.576 min in group LD

100, with all these differences being statistically significant (P<0.00001).

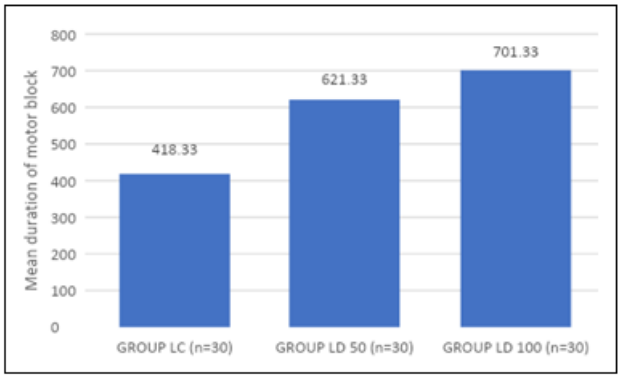

Figure 4: Comparison of Duration of Motor Block (in minutes) (N=90)

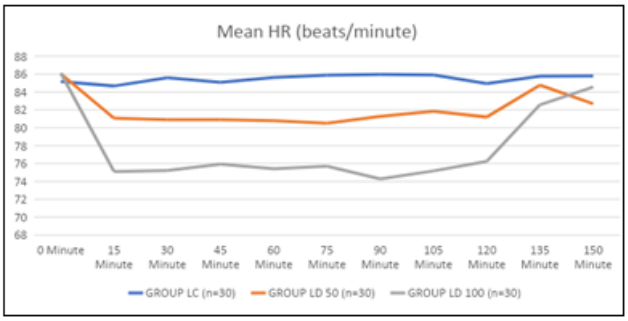

Figure 5: Mean Heart rate (beats/min) in study participants during surgery (N=90)

The mean HR for group LC was 85.17± 6.395, group LD 50 was 86.03± 5.928 and 86.10± 11.043 for group LD 100 at baseline. The patients' heart rates did show significant fluctuations during the procedure when compared to the baseline and with each other. there was a statistically significant differences observed between the three groups at all time intervals. (P <0.05).

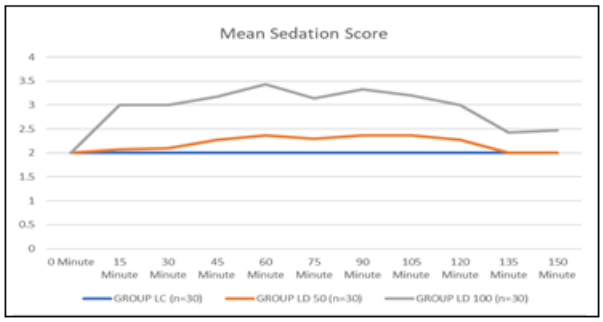

Figure 6: Mean Sedation score in study participants during surgery (N=90)

The mean sedation score for group LC was 2.00± 0.000, group LD 50 was 2.00± 0.000 and 2.00± 0.000 for group LD 100 at baseline. Throughout the procedure, the patients' mean sedation score increased from the initial baseline measurement, with the score consistently increasing during the procedure. Additionally, the study revealed significant differences among the groups, with the group LD 100 exhibiting a significantly higher sedation score than the other two groups (P <0.00001).

Table 5: Complications observed in the Studied cases (N=90)

Procedures Performed	Group LC (n=30)		Group LD 50 (n=30)		Group LD 100 (n=30)	
	n	%	N	%	n	%
Hypotension	0	0	0	0	0	0
Bradycardia	0	0	4	13.33	7	23.33

Four subjects in the LD 50 group had bradycardia. Within the LD 100 group, 7 subjects had bradycardia, whereas none of the patients exhibited hypotension.

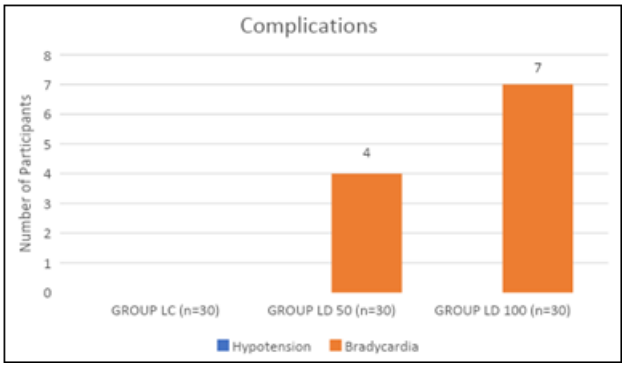

Figure 7: Complications observed in study participants (N=90)

4. Discussion

In comparison between groups LD100, LD 50 and LC, group LD 100 exhibited a significantly (P< 0.00001) faster onset of sensory and motor blockade, whereas in between group LD 50 and LC, group LD 50 had a significantly (P< 0.00001) faster onset of sensory and motor blockade when compared to group LC.

The results of this investigation are consistent with those of a prior study by Kaur H et al. [6], which discovered that the dexmedetomidine group experienced sensory and motor blockade onset times of 6.9 and 7.6 minutes, respectively, while the control group experienced these durations at 7.6 and 8.3 minutes.

Reddy et al. [7] also observed that a higher dosage of dexmedetomidine accelerates the onset of both motor and sensory block, which aligns with our study results.

Among LD100, LD50 and LC, the duration of sensory and motor blockade showed a significant association (P <0.00001) with higher dexmedetomidine doses (LD 100> LD50). Whereas in between LD 50 and LC it was observed that duration of sensory and motor blockade was significantly higher (P <0.00001) in group LD50.

The observations in our study was similar with the findings of the studies conducted by Esmaoglu et al. [8] , Abdulatif et al. [9], Kaygusuz et al. [10] and Ammar et al. [11].

The mean heart rate in LD100 group was significantly lower than that in LD50 and LC group intraoperatively from 15 min to 120 min, while in between the group LD50 and LC, the mean heart rate was significantly lower in LD50(p<0.05). Similar to our study, Ghazaly HF et al.[12] also found that

there was significant decrease in mean heart rate in both the doses(50µg and 100µg), and the decrease being greater with increasing dose.

The study demonstrated that the patients in the LD100 group were more sedated than those in the LD50 (LD100 vs LD50, $p<0.05$) and LC(LD100 vs LC, $p<0.05$) groups. Also patients in LD50 group were more sedated than patients in LC group. In a study conducted by Reddy et al. [7] it was observed that the group with LD100 experienced a considerably higher level of sedation compared to the LD50 group. However, Balakrishnan et al. [13] also discovered a notable rise in sedation scores among the LD100 group when compared to the other groups.

During our investigation, it was observed that 7 patients in LD 100 group and 4 patients in LD 50 group experienced bradycardia, for which Inj. Atropine 0.6mg IV was given. But hypotension was not seen in any group. In a related study, Balakrishnan S. et al. [13] discovered that while bradycardia only occurred in eight patients in the LD100 group (administered with atropine) and was not seen in the other three groups (LS, LD30, LD60), none of the patients in any group experienced hypotension.

In a recent meta-analysis [14] it was found that perineural dexmedetomidine can lead to temporary bradycardia and hypotension. However, these effects can be easily reversed with the use of atropine or ephedrine.

5. Conclusions

In this double blinded comparative study, we compared the clinical profile of two different doses of dexmedetomidine (50µg and 100µg) as adjuvant to levobupivacaine 0.5% in supraclavicular brachial plexus block. We found that both the 50µg and 100µg doses made the onset faster and prolonged the duration of sensorimotor block and analgesia. Even though the dose of 100µg of dexmedetomidine caused a significant improvement in the block characteristics compared to 50µg, this advantage was offset by increased incidence of bradycardia and increased sedation and hence need vigilant monitoring. Thus, we conclude that dexmedetomidine when used in a dose of 50µg as adjuvant in peripheral nerve block, has the advantages of conscious sedation and hemodynamic stability in addition to significant improvement in block characteristics.

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