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A clinical comparison between 0.375% levobupivacaine and 0.375% levobupivacaine with 1µg/Kg dexmedetomidine in brachial plexus block by supraclavicular approach for upper limb surgeries

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Abstract
Introduction: Dexmedetomiodine is a selective α2 agonist drug. This study aimed to assess the onset and duration of sensory and motor block and postoperative analgesia in the first 12 hours after surgery after adding Dexmedetomidine with 0.375% Levobupivacaine for brachial plexus block.
Material and Method: 100 patients aged 18-60 years of ASA Grade I & II posted for upper limb surgeries under supraclavicular brachial plexus block were randomly allocated into two groups with 50 patients in each. Group L and L+D received 35cc of 0.375% injection Levobupivacaine and 35cc of 0.375% Levobupivacaine with 1 µg/kg of injection Dexmedetomidine respectively through nerve stimulator guided supraclavicular block. Onset and duration of sensory and motor block, time to first and total analgesic need were noted postoperatively for 12 hours.
Results: Sensory and motor block onset time was significantly lower in the Group L+D than Group L (p=0.001). Duration of sensory and motor block was significantly longer in the Group L+D than Group L (p=0.001). The time to the first analgesic requirement was longer in Group L+D than Group L (p=0.001). The total analgesic requirement was significantly lower in Group L+D than Group L (p=0.001).Heart rate and systolic and diastolic blood pressure was significantly lower after drug administration in group L+D than group L.
Conclusion: Dexmedetomidine added to Levobupivacaine causes early onset and increased duration of sensory and motor block and prolonged period of postoperative analgesia in supraclavicular brachial plexus block. Therefore, Dexmedetomidine seems to be a good alternate adjuvant.

Keywords: Levobupivacaine, dexmedetomidine, supraclavicular block

Introduction

For upper extremity surgeries, there are two choices of anaesthesia- General anaesthesia and regional anaesthesia. These days upper limb surgeries are mainly done under regional anaesthesia. In today's trend brachial plexus block is the preferred practice of regional anaesthesia for upper limb surgeries [1]. There is always been a search of a local anaesthetic drug which has less cardiovascular and central nervous system (CNS) toxicity. Levobupivacaine, an [-s-] enantiomer of local anaesthetic drug Bupivacaine is also a long-acting drug. It is having a similar pharmacological profile as Bupivacaine but is associated with a reduced toxicity profile [9].

An ideal adjuvant was always in need of regional nerve block. Alpha 2 agonists have sedative and analgesic properties and produce perioperative sympatholysis. Dexmedetomidine, a new alpha 2 agonist drug, is more selective for alpha 2 receptors as compared to other agonist drugs. It has been reported in various studies that Dexmedetomidine enhances motor and sensory block and it prolongs postoperative analgesia when used as an adjuvant with a local anaesthetic drug for regional nerve blocks [11].

So, in our study we intended to investigate the adjuvant effects of Dexmedetomidine on Levobupivacaine when compared to Levobupivacaine alone in terms of onset of sensory and motor blockade and duration of postoperative analgesia in supraclavicular nerve block for upper limb surgeries.

Material and Methods

It was a prospective randomized comparative study involving 100 adult patients aged 18-60

years, ASA Grade I & II of either gender posted for upper limb surgeries under supraclavicular brachial plexus block. Those who refused for study, history of anaphylaxis to local anaesthetics, patients with a history of significant coexisting systemic diseases, patient with coagulopathy and neuropathy were excluded from study. After getting approval from the institutional ethical committee, Patients were divided into two groups of 50 each. After a thorough pre-anaesthetic evaluation and minimal necessary investigation done, a written informed consent was taken from all the patients.

Patients were shifted to operation theatre and baseline vitals were noted. After achieving an intravenous access using 18G intravenous cannula in unaffected hand an intravenous fluid ringer lactate started. All patients received a brachial plexus block through the supraclavicular approach through peripheral nerve stimulator. A 22G 50mm long stimulating needle of peripheral nerve stimulator inserted caudal, medial, and in posterior direction. The goal was to achieve an isolated muscle twitches in all fingers either in extension or flexion to verify needle proximity to the lower trunks of the plexus. After negative aspiration, the local anaesthetic drug solution in the labelled syringe was injected after repeated aspiration every 4-6 ml to avoid intravascular injection. Group L received 35cc of 0.375% injection Levobupivacaine and group LD received 35cc of 0.375% Levobupivacaine with 1µg /kg of injection Dexmedetomidine. Sensory block evaluated by pinprick method. Sensory block graded as,

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

Motor block assessment was done according to the modified Bromage scale for upper extremities on a three-point scale;

- **Grade 0:** Normal motor function with full flexion and extension of elbow, wrist, and fingers.
- **Grade 1:** Decreased motor strength with the ability to move a finger
- **Grade 2:** Complete motor block with the inability to move fingers.

Onset of sensory block was taken following attainment of the complete sensory block (Grade 2 block) which is anaesthesia on all nerve territories. The onset of motor block was taken following attainment of the complete motor block that is the absence of voluntary movement on fingers (Grade 2 block). Duration of sensory block analysed as the time period between the onset of sensory block and complete recovery of anaesthesia of the blocked nerves. The duration of motor block was assessed as the time period between the onset of motor block and resolution of motor block. Patients monitored for HR, SBP, DBP, RR, SPO2 after drug administration and then till 12hr postoperatively. Pain assessed using Visual analog scale (VAS) scale after drug administration and then 12hr postoperatively. Duration of analgesia was taken as the period between the end of local anaesthetic solution administration and the first analgesic need.

- Patients shifted to the postoperative recovery room. All patients received oxygen supplementation by face mask @ 3-4L/min with FiO2-0.5%
- Side effects like nausea, vomiting, hypotension, bradycardia, sedation were recorded.

Statistical analysis

Intergroup mean comparison was done using Unpaired 't' test; the comparison of proportion between the two groups was done using Fisher's Exact Test. A p value of < 0.05 was taken as statistically significant. OPEN EPI software for calculating the sample sized based on comparison of means of two samples was used and according to that we had included 50 patients in each group.

Results

There were 50 (50.0%) patients each in Group L and Group L+D. There was a male preponderance in both the groups. The mean age in the Group L was 37.44 ± 13.87 years and in the Group L+D was 35.48 ± 12.51 years. The mean weight in Group L was 62.66 ± 6.89 kg and in Group L+D it was 62.60 ± 7.49 kg. Majority of the patients in both the groups were in ASA Grade I. (table 1)

The mean heart rate was significantly lower in Group L+D in comparison to Group L ($p<0.05$). The mean SBP and DBP was significantly lower in Group L+D in comparison to Group L ($p<0.05$). In Group L, none of the patients experienced any side effects. (table 3) In Group L+D, 7 (14.0%) patients had hypotension.

The mean sensory block onset time and duration in Group L was 13.16 ± 1.99 minutes and 457.64 ± 62.23 minutes respectively and in Group L+D was 3.68 ± 1.33 minutes and 661.08 ± 61.00 minutes respectively. The mean onset of sensory block was faster in Group L+D and also it was longer in Group L+D in comparison to Group L (p=0.001) (fig.1). The mean motor block onset time and duration in Group L was 16.78 ± 2.22 minutes and 399.18 ± 53.53 minutes respectively and in Group L+D was 6.06 ± 1.97 minutes and 573.04 ± 59.80 minutes respectively (fig.2). The mean onset of motor block was faster in Group L+D and also it was longer in Group L+D in comparison to Group L. (p=0.001).(table 2)

The mean time to first analgesic requirement and mean total analgesic requirement in Group L was 467.52 ± 68.08 minutes 2.64 ± 0.49 respectively and in Group L+D was 674.28 ± 62.65 minutes and 0.58 ± 0.61 respectively. The difference was found to be statistically significant (p=0.001). The mean time to first analgesic requirement was longer and mean total analgesic requirement was significantly lower in Group L+D in comparison to Group L. (table 2)

Table 1: Demographic profile

(Group L Group L+D)		
Male: Female ratio	33:17	37:13
Age (Mean)	37.44 ± 13.87	35.48 ± 12.51
Weight (Mean)	62.66 ± 6.89	62.60 ± 7.49
ASA Grade I/II (%)	92/8	90/8

Table 2: Characteristics of blockade in patients

Parameters	Group L [Mean±SD]	Group L+D [Mean±SD]	't' value	P value
Sensory block onset time (min)	13.16 ± 1.99	3.68 ± 1.33	27.962, df=98	0.001
Sensory block duration (min)	457.64 ± 60.23	661.08 ± 61.00	-16.781, df=98	0.001
Motor block onset time (min)	16.78 ± 2.22	6.06 ± 1.97	25.547, df=98	0.001
Motor block duration (min)	399.18 ± 53.53	573.04 ± 59.80	-15.317, df=98	0.001
Time to first analgesic requirement (min)	467.52 ± 68.08	674.28 ± 62.65	-15.802, df=98	0.001
Total analgesic need (mg)	2.64 ± 0.49	0.58 ± 0.61	18.710, df=98	0.001

Table 3: Comparision of side effects

Side effects	Group L (n=50)	Group L+D (n=50)
Nausea	0	0
Vomiting	0	0
Sedation	0	0
Hypotension	0	7

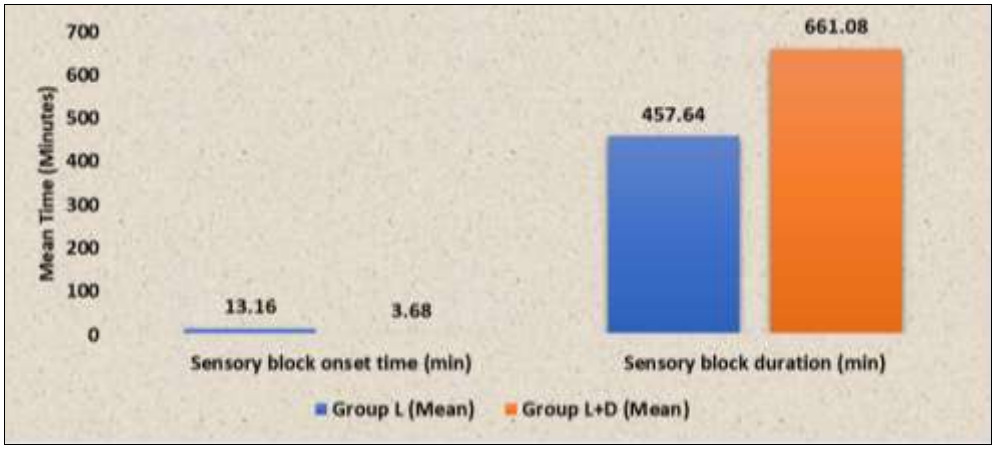

Fig 1: Bar diagram showing comparison of mean sensory onset and duration of sensory block between the two groups

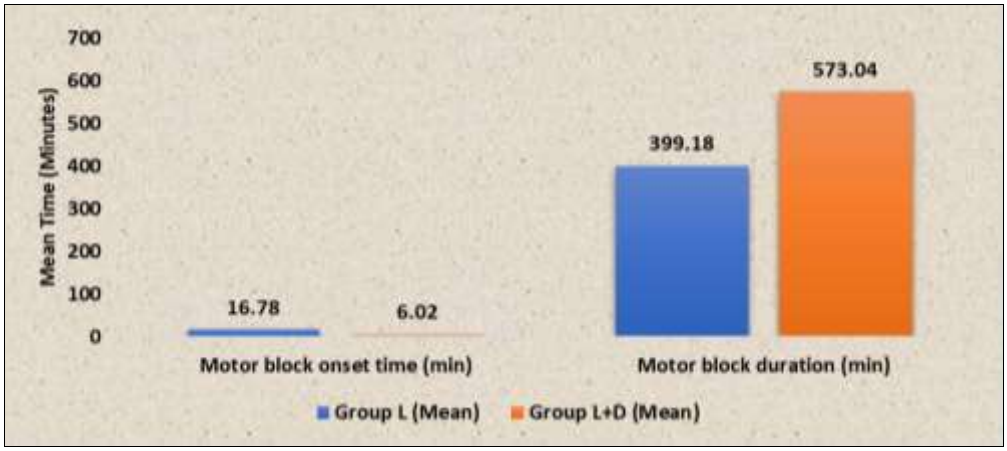

Fig 2: Bar diagram showing comparison of mean motor onset and duration of motor block between the two groups

Discussion

In today's scenario brachial plexus block is the preferred technique of anaesthesia for upper limb surgeries as it allows localized and targeted anaesthesia of the upper limb as well as postoperative analgesia. Supraclavicular brachial plexus block as the preferred mode of anaesthesia for upper limb surgeries because it blocks all the sensory, motor, and sympathetic supply of the upper limb [16].

Levobupivacaine over bupivacaine

Bupivacaine is currently the most commonly used anaesthetic drug for regional anesthesia as it has a good safety profile but it may cause fatal cardiotoxicity if accidentally injected intravascularly. Levobupivacaine, an [-s-] enantiomer of local anaesthetic drug Bupivacaine is also a long-acting drug. It is having a similar pharmacological profile as Bupivacaine but is associated with a reduced toxicity profile.

So, in our study, we preferred to use Levobupivacaine as a local anaesthetic drug with comparatively less concentration that is 0.375% to increase its safety margin.

Dexmedetomidine over other adjuvants

α2 adrenoreceptor agonist drugs when added with local anaesthetic drugs cause early onset of sensory and motor block plus prolong the duration of sensory and motor block and postoperative analgesia.

We chose Dexmedetomidine as an adjuvant with Levobupivacaine because it is a very specific and selective α2 adrenoreceptor agonist, with α2/α1 selectivity and superiority of Dexmedetomidine has been already demonstrated in comparison to clonidine and Ketrorolac in various studies **[11,12,13,14,15]**.Dexmedetomidine causes presynaptic activation of α2 adrenoreceptor in the central nervous system and inhibits the release of norepinephrine and peripheral pain signals which possibly defines its analgesic property**[19]**. Central α2 adrenoreceptor agonist action causes a decrease in substance P release at the dorsal root neuron and causes an analgesic effect**.[15]** Further to increase its safety profile we preferred to use 1µg/kg.

Demographic profile

In our study, there were 50 patients each in Group L and Group L+D**.** All the patients of both groups were comparable in their demographic profile.

Onset time of sensory and motor block

In our study, we found that Dexmedetomidine when added to Levobupivacaine causes early onset of sensory and motor block. The mean sensory and motor block onset time was significantly lower in the Group L+D in comparison to Group L.

Similar findings were reported by Haramritpal Kaur *et al.* [17], they preferred to add Dexmedetomidine as an adjuvant with Levobupivacaine for supraclavicular brachial plexus block and found that comparatively early onset of sensory block in Dexmedetomidine group that is 6.96 ± 1.077 min than Levobupivacaine group that is 7.6 ± 1.006 min and also shortens motor block onset time that is 7.6 ± 1.006 min compared to 8.3 ± 0.877 min in Levobupivacaine group.

Similarly Arvinder Pal Singh *et al.* [19], Nasir Hussain *et al.* [20], in their study added Dexmedetomidine with local anaesthetic agents and concluded the same.

Duration of sensory and motor Block

In our study we found that the addition of Dexmedetomidine as an adjuvant to Levobupivacaine causes prolonged sensory and motor block duration. We observed that mean duration of sensory block was significantly longer in the Group L+D (661.08 ± 61.0 minutes) in comparison to Group L (457.64 ± 62.23 minutes) (p=0.001) and mean duration of motor block was significantly longer in the Group L+D (573.04 ± 59.80 minutes) in comparison to Group L (399.18 ± 53.53 minutes) (p=0.001).

The findings in our study is consistent with the findings of Saumya Biswas *et al.* [10] they added 100 µg Dexmedetomidine with 0.5% Levobupivacaine and observed that duration of sensory block was longer that is 898±32.33 min compared to 645± 70.11 min in Levobupivacaine plain and motor blocks duration in Dexmedetomidine group was more that is 840±50.23 min compared to512± 60.13 min in Levobupivacaine plain. Similar results were reported by Neerja Bharti *et al.* [18] and Nasir Hussain *et al.* [20] in their study.

Time to first analgesic requirement and total need

In our study the mean time to the first analgesic requirement was longer in Group L+D in comparison to Group L. The mean total analgesic requirement was significantly lower in Group L+D in comparison to Group L. Our findings are in consistent with the findings of Sarita S Swami *et al.* [11]. They compared Dexmedetomidine and Clonidine as an adjuvant to local anaesthetic drugs for supraclavicular brachial plexus block and came to the conclusion that postoperative analgesia and time for rescue analgesia was prolonged in patients receiving Dexmedetomidine as an adjuvant when compared to patients receiving Clonidine.

Intraoperative heart rate changes

In our study, we noticed that in both the group's heart rate decreased after drug administration. However, bradycardia did not occur in our study so there was no need for pharmacological intervention. Our findings are in concordant with the findings of Atul Dixit *et al.* [21] who also found a decrease in heart rate after giving 1µg/kg Dexmedetomidine with Levobupivacaine but the mean heart rate remained to be normal.

Intraoperative blood pressure changes

We found that SBP and DBP were significantly lower in Group L+D in comparison to Group L ($p<0.05$). 14% patients of L+D Group developed hypotension, but there was no need for any pharmacological intervention. Similar results were reported by Arvinder Pal Singh *et al.* [19] in their study.

In terms of side effects, none of the patients in both groups had nausea, vomiting, and sedation. As in our institute, USG guided block modality is not available so we preferred to use a nerve stimulator guided supraclavicular brachial plexus blocks.

Conclusion

we finally conclude that Dexmedetomidine as an adjuvatnt to Levobupivacaine reduces the onset and prolongs the duration of sensory & motor blockade & provides a good post- operative analgesia thus reducing the need of rescue analgesia in post-operative period and on the other hand it is

associated with reduced heart rate and brief hypotension for which continuous heart rate and blood pressure monitoring are required.

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