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Comparison of Dexmedetomidine with 0.5% Levobupivacaine and 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block

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Abstract

Background and Aims: Dexmedetomidine as an adjuvant to local anaesthetic in supraclavicular plexus block. We compared the onset time of sensory and motor block and postoperative analgesia.

Methods: Sixty patients scheduled for upper limb surgeries were divided into two equal groups, group LD and RD, randomly. The patients received brachial plexus block via supraclavicular route with the help of nerve stimulator. In group LD (n=30) 30cc of 0.5% levobupivacaine with 1µg/kg dexmedetomidine and in group RD (n=30) 30cc of 0.5% ropivacaine with 1µg/kg dexmedetomidine was given. Onset of motor and sensory block and time to first rescue analgesia were recorded.

Results: Sensory and motor onset time was significantly early in Group LD compared with RD ($P< 0.05$). Duration of post operative analgesia was significantly longer in Group LD compared to Group RD ($P<0.05$).

Conclusion: Addition of Dexmeditomidine to Levobupivacaine for supraclavicular brachial plexus block shorthens the onset times for sensory and motor blocks and significantly prolonged the duration of analgesia.

Keywords: Analgesia; Dexmedetomidine; Levobupivacaine; Ropivacaine; Sensory; Motor.

Introduction

Peripheral nerve block as an anesthetic technique plays an important role in modern regional anesthesia. Upper limb surgeries below the shoulder joint are mostly performed under peripheral blocks such as the brachial plexus block. Peripheral nerve blocks not only provide intra-operative anesthesia, but also extend analgesia in the post-operative period without major systemic side-effects by minimizing stress response and using minimal anesthetic drugs [1].

Its increased popularity is because of advancements in regional anesthesia techniques in terms of local anesthetics drugs, newer adjuvant and use of pheripheral nerve stimulator or ultra sound for safe and successful conduct of block.

Levobupivacaine and ropivacaine are long-acting local anesthetics used for peripheral nerve blocks to provide prolonged postoperative analgesia. Levobupivacaine has been reported to have a longer duration of analgesic effect compared with ropivacaine when used for spinal and epidural anesthesia [2-5].

Studies on animals revealed that compared with ropivacaine, levobupivacaine had similar or more pronounced nerve blocking effects, depending on the concentration. Clinical studies have shown that levobupivacaine and ropivacaine have fewer adverse affects on the cardiovascular system and central nervous system (CNS) than does bupivacaine making

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them more advantageous in regional anesthetic techniques that require large volumes of local anesthetics [6-8].

Adding dexmedetomidine to local anesthetics during peripheral nerve blockade [9] and regional anesthesia [10] procedures may also prove efficacious for the surgical patients. In human study, dexmedetomidine has also shown to prolong the duration of the block and post-operative analgesia when added to local anesthetic in various regional blocks [11,12].

Hence the present study is aimed to compare the effectiveness of 0.5% levobupivacaine and 0.5% ropivacaine with 1μg/kg of dexmedetomidine in supraclavicular brachial plexus block in terms of onset of sensory and motor blockade,duration of analgesia and complications,if any.

Materials and Methods

The present study is a prospective, randomized, double blinded comparative study including 60 patients with ASA grade I, II of either sex, aged between 20 and 60 years scheduled for upper limb surgeries of fracture radius ulna, post burn contracture release, debridment and tendon repairs were included in the study. Exclusion criteria were patients not giving consent, existence of peripheral neuropathy, bleeding disorders, local cutaneous infections, and patient with hypersensitivity to either of the drugs used in the study and pregnant women and lactating mothers.

After obtaining approval from institutional ethical committee and informed consent from patients fulfilling the inclusion criteria, cases were divided randomly into two groups: Group LD: received Inj. levobupivacaine hydrochloride 0.5% 30cc and 1μ/kg dexmedetomidine and Group RD: received Inj. ropivacaine hydrochloride 0.5% 30cc and 1μ/kg dexmedetomidine. Each individual was allocated to respective group by computer generated randomization chart. Neither patients nor observer were told about the drug injected .

A thorough preoperative evaluation was performed. After the patient was taken on to operation table, and was monitored using pulseoximeter, ECG and noninvasive blood pressure monitors. An intravenous access was secured using an in-dwelling cannula of appropriate size on the normal limb. Oxygen supplementation was given with nasal cannula at 2 litres/min. Brachial plexus block was performed by supraclavicular approach using pheripheral nerve stimulator.

Patient was positioned supine with head turned about 30 degree to contralateral side. After palpating the interscalene groove and tracing it to the most inferior point, which is just posterior to the subclavian arterial pulse, the latter can be felt in the plane just medial to the midpoint of the clavicle.

Then local infiltration with 2cc of 2% plain lignocaine was given to minimize needle pain. A 22G, 50 mm stimuplex needle with the nerve stimulator was directed just above and posterior to the subclavian arterial pulse and directed caudally at a very flat angle against the skin. The needle was advanced until the flexion of finger was noted.

If contraction was still observed with the intensity of stimulating current decreased to 0.5mA, then following protocol was followed: Group LD received 30 cc of 0.5% injection levobupivacaine hydrochloride and 1μ/kg dexmedetomidine and Group RD received 30 cc of 0.5% injection ropivacaine hydrochloride and 1μg/kg dexmedetomidine. If the rib was encountered without paraesthesia or if blood was encountered, the needle was withdrawn and the landmarks as well as the plane of needle insertion path were re-evaluated.

Patients were evaluated to determine the loss of arm abduction (deltoid sign as sign of successive motor blockade). Sensory block was assessed by pin prick over the surgical site. Failure of loss of arm abduction or pain at surgical site after 30 min was considered to be block failure and hence general anaesthesia was given to those patients and thus was excluded from the study. After evidence of successful motor and sensory block, surgery was performed.

Patients were monitored every hourly for 10 hours for heart rate, blood pressure, SpO_2, onset of sensory block, onset of motor block, and complications if any, then after 10 hours patients were shifted to ward and the time of requirement of first rescue analgesic was noted.

Post-operative pain was also assessed by using visual analog scale (VAS) and VAS less than 4 was given rescue with intravenous diclofenac 1-2mg/kg.

Statistical Analysis

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis

Results

After studying 60 cases, the observation and results were summarized in tabulated form. Table 1 shows the distribution of patients according to mean age with standard deviation and Table 2 shows sex incidence of patients in both the groups with no significant difference. Table 3 shows the mean onset time of sensory blockade and motor blockade in minutes in both the groups. Sensory onset time was calculated from time of injection of drug to onset of dull sensation on any of the nerve distribution.

Motor onset time was calculated from time of injection of drug to when patient felt heaviness on abduction of arm at shoulder. The mean sensory onset time in Group LD was 8.77±1.33 mins and mean motor onset time was 12.93±1.76 mins and Group RD the mean sensory onset was 10.30±2.04 mins, mean motor onset time being 14.80±1.71 mins. Sensory and motor onset time was earlier in Group LD when compared to Group RD, and it was statistically significant (P<0.001).

Table 4 shows the duration of analgesia with standard deviation in hours. Duration of sensory block was calculated from the time between the peak effect time and feeling of dull sensation in any of the nerve distributions.

The duration of effective analgesia was calculated from the time between the end of local anesthetic administration to the time when VAS was less than 4 and rescue analgesic was administered when VAS score was equal to or greater than 4.

Table 1: Age distribution of patients studied (Samples are age matched with P=0.266)

Age in years	Ropivacaine+dexmedetomidine	Levobupivacaine+dexmedetomidine	Total
21-30	11(36.7%)	8(26.7%)	19(31.7%)
31-40	10(33.3%)	10(33.3%)	20(33.3%)
41-50	5(16.7%)	5(16.7%)	10(16.7%)
51-60	4(13.3%)	7(23.3%)	11(18.3%)
Total	30(100%)	30(100%)	60(100%)
Mean ± SD	35.93±10.51	39.20±11.96	37.57±11.29

Table 2: Gender distribution of patients studied (Samples are gender matched with P=0.118)

Gender	Ropivacaine+dexmedetomidine	Levobupivacaine+dexmedetomidine	Total
Female	10(33.3%)	16(53.3%)	26(43.3%)
Male	20(66.7%)	14(46.7%)	34(56.7%)
Total	30(100%)	30(100%)	60(100%)

Table 3: Onset of sensory and Motor (In Mins) in two groups studied

Onset (mins)	Ropivacaine+dexmedetomidine	Levobupivacaine+dexmedetomidine	Total	P value
Sensory	10.30±2.04	8.77±1.33	9.53±1.87	0.001**
Motor	14.80±1.71	12.93±1.76	13.87±1.96	<0.001**

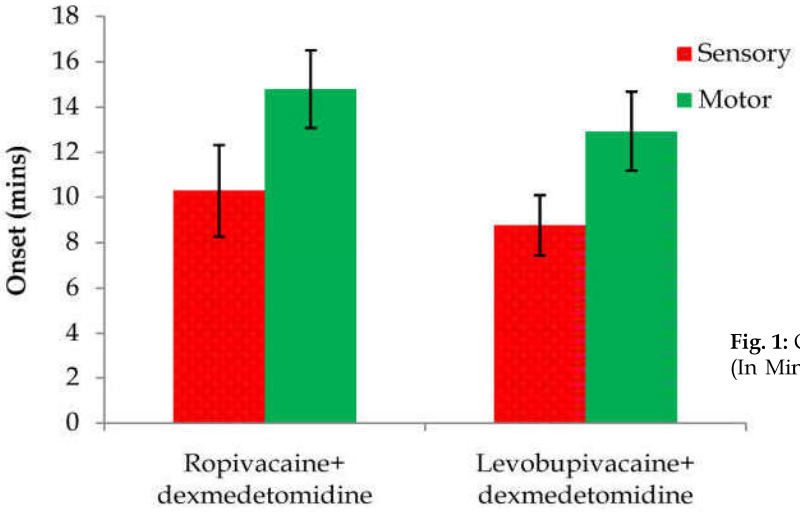

Fig. 1: Onset of sensory and Motor (In Mins) in two groups studied

Table 4: Duration of Analgesia (hrs) in two groups of patients studied

Duration of Analgesia (hrs)	Ropivacaine+dexmedetomidine	Levobupivacaine+dexmedetomidine	Total
<12	3(10%)	0(0%)	3(5%)
12-18	27(90%)	11(36.7%)	38(63.3%)
18-24	0(0%)	19(63.3%)	19(31.7%)
Total	30(100%)	30(100%)	60(100%)
Mean ± SD	13.97±2.03	19.30±2.71	16.63±3.58

P<0.001**, significant, Student t test

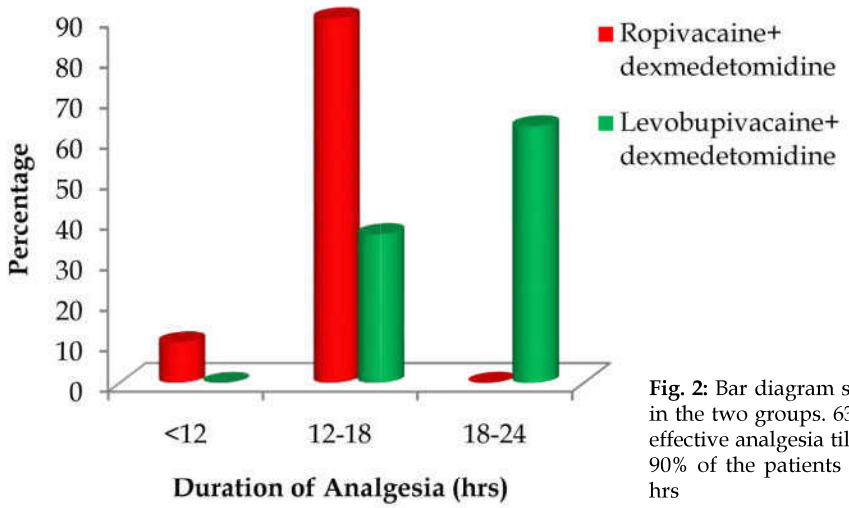

Fig. 2: Bar diagram showing the duration of analgesia in the two groups. 63.3% of patients in Group LD had effective analgesia till 18-24 hrs where as in Group RD 90% of the patients had effective analgesia till 12-18 hrs

Table 4 shows the duration of analgesia in the postoperative period in the two groups in hours.The mean duration of analgesia in Group LD (19.30± 2.71 hrs) was significantly longer than Group RD (13.97±2.03 hrs), both the duration of effective analgesia and the time for rescue analgesia were statistically significant ($P < 0.05$). At VAS score ≥ 4, rescue analgesia was given (Inj. Diclofenac, 1–2 mg/kg i.v.). No significant changes was found in hemodynamic parameters between both the groups.

Discussion

The supracla-vicular approach performed at trunk level provides the most complete and reliable anesthesia as it provides anesthesia of the entire upper extremity in the most consistent, time-efficient manner of many brachial plexus techniques for elbow, forearm, and hand surgery [13].

Dexmedetomidine, a highly selective, α-adrenergic agonist, has analgesic, sedative, anesthetic sparing effects when used in systemic route [14]. Use of dexmedetomidine as an adjuvant mixed with local anesthetics has been performed with neuraxial anesthesia in both adult and pediatric patients [15,16]. Peripherally, α2 agonists produce analgesia by reducing release of norepinephrine and causing α2 receptor independent inhibitory effects on nerve fiber action potentials. Centrally, α2 agonists produce analgesia and sedation by inhibiting substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activating α2 adrenoceptors in the locus coeruleus [17,18].

A study by Brumett et al [19] showed that dexmedetomidine enhances duration of bupivacaine anaesthesia and analgesia of sciatic nerve block in rats without any damage to nerve.

Kousugi et al in their study found high concentrations of dexmedetomidine inhibit compound action potentials in frog sciatic nerves without α2 adrenorecptors activation in a concentration dependent manner and reversibly [20].

In this prospective, randomized, and double-blinded trial, we compared the effect of 1 microgram/kg of dexmedetomidine as an adjuvant with 30 ml 0.50% ropivacaine and 30 ml of 0.5% levobupivacaine in supraclavicular brachial plexus block, on the onset time of sensory and motor block as well as on the postoperative rescue analgesic.

The statistically significant mean onset of sensory and motor blockade was observed earlier in group LD compared to group RD. Similar results were

observed by Mageswaran and Choy [21]. On the contrary, Nodulas et al found that both 0.5% Levobupivacaine and 0.5% ropivacaine had similar onset of action [22]. Similarly in the study conducted by Deshpande et al, they found the onset of sensory and motor block early with levobupivacaine 0.5% with a statistically high significance [23]. Esmaoghu et al found that adding dexmedetomedine to levobupivacaine for an axillary brachial plexus block shortens both the sensory and motor block onset time, extends the block duration, and the analgesia period which was also similar to our study [11].

There was a significant difference ($P < 0.05$) in time of rescue analgesia, viz. prolonged for levobupivacaine with dexmedetomidine (19.30±2.71 h) than for ropivacaine with dexmedetomidine (13.97±2.03h).

Liisanantti et. al. [24] reported that the duration of analgesia when using levobupivacaine for brachial plexus block was the same asthat when using ropivicaine. Casati et. al. [25] reported that there were no difference in postoperative pain scores comparing levobupivacaine and ropivacaine.

However, Cline et. al. [26] showed a longer analgesic effect of levobupivacaine compared with ropivacaine. Mankad et. al. [13] did a study on 60 patients found that Levobupivacaine, a novel long-acting local anesthetic agent, having better profile in terms of duration of analgesia, with a considered disadvantage of delayed wearing off of motor blockade, offers an alternative to ropivacaine for brachial plexus block in upper limb surgeries. Biswas et. al. [27] concluded in their study that dexmedetomidine(1 microgram/kg) added to levobupivacaine in supraclavicular brachial plexus block prolongs the duration of block and the duration of postoperative analgesia. kulkarni et. al. [28] in their study compared 0.5% levobupivacaine and 0.5% ropivacaine in supraclavicular brachial plexus block for upper limb surgeries and concluded that 0.5% levobupivaine provides rapid onset of sensory and motor blockade and prolonged duration of analgesia which is similar to our study.

To conclude, in our study we found that dexmedetomidine when added to levobupivacaine for supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs their duration. The significantly prolonged duration of analgesia obviates the need for any additional analgesics. The added advantage of conscious sedation, hemodynamic stability, and minimal side effects makes it a potential adjuvant for nerve blocks.

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