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CLINICAL EVALUATION OF ROPIVACAINE VERSUS ROPIVACAINE WITH LIGNOCAINE AND ADRENALINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK: A RANDOMISED DOUBLE BLIND STUDY

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Abstract

Introduction: Lignocaine with adrenaline is used with local anaesthetics to improve the onset and increase the duration of nerve block. The present study aimed to evaluate it's effect when used together with ropivacaine.

Objective: To evaluate the effect of adding 2% lignocaine with adrenaline to 0.5% ropivacaine, for supraclavicular brachial plexus blockade on the onset and duration of sensory and motor block, duration of analgesia and effect on hemodynamic parameters.

Material and method: In a prospective randomized double blind study done in Department of Anaesthesia, Himalayan Hospital, supraclavicular brachial plexus blockade by the use of nerve stimulator was performed in 50 patients using 20ml ropivacaine 0.75%. Group A had 10ml of distilled water and Group B had 10 ml of 2% lignocaine with adrenaline (1:200,000), so that final concentration of both groups was 30ml of 0.5% ropivacaine. Sensory function was tested using pinprick method, motor function by modified bromage scale, sedation by sedation score and analgesia by VAS score.

Results: The lignocaine group showed an earlier onset of motor and sensory block by about 4.88 minutes which was much denser in nature. There was no change in duration of block and analgesia as compared with the control group. No side effects were noted.

Conclusion: The addition of 2% lignocaine with adrenaline to ropivacaine 0.5%, for brachial plexus blockade, provides an earlier onset of block, with no effect on the duration of block and analgesia.

Keywords: Anaesthetic technique, lignocaine with adrenaline, duration of analgesia, ropivacaine, supraclavicular brachial plexus block

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Introduction:

Supraclavicular blocks are the most commonly performed brachial plexus blocks as the typical feature of these blocks include rapid onset, predictable and dense anaesthesia, along with its high success rate. ⁽¹⁾ Ropivacaine a chemical congener of bupivacaine is an amide based local

anaesthetic with potentially improved safety profile. ⁽²⁾ Addition of adjuvants like 2% lignocaine with adrenaline have been found to increase the duration of regional block and also improve the onset of block respectively. With this background in mind we designed this prospective randomized double blind study to identify the effect of lignocaine with

adrenaline to ropivacaine in brachial plexus block by supraclavicular approach using nerve stimulator.

Material and method:

The following study was done in Department of Anaesthesia, Himalayan Hospital in year 2012 for a duration of 6 months. After approval from the local ethics committee, a prospective, randomised, double-blind controlled trial was designed. Written informed consent was obtained from all patients selected for inclusion in the present study. The study included a total of 50 patients, who were aged ≥ 18 years, weighed ≥ 40 kg, had ASA (American Society of Anesthesiologists) physical status I–III, and were scheduled to undergo elective surgery on the upper extremity. Patients who refused to participate in the present study, had neurological diseases of the upper extremities, had contraindications to regional anaesthesia and any of the study drugs (i.e. ropivacaine or lignocaine), and/or were pregnant or lactating, were excluded from the study.

Patients were randomly assigned to any one of two groups (i.e. either the lignocaine or control group); each group had a total of 25 patients. The anaesthetist who performed the randomisation also prepared the drug solutions, but was otherwise not involved in the study. In the preoperative area, an intravenous (IV) line was established and intravenous midazolam 1–2 mg was administered to all 50 patients.

The patients were then moved to the operating room, where their heart rate, respiratory rate, oxygen saturation and noninvasive blood pressure were monitored. The supraclavicular blocks were performed by an anaesthetist who was unaware of the composition of the local anaesthetic solution administered, as per the method described by Franco.⁽³⁾ A 22-gauge 50-mm needle (Stimuplex®A 50; B.Braun, Melsungen, Germany) connected to a nerve stimulator (NM-20®; INMED Equipments Pvt Ltd, Vadodara, India) was inserted at an initial

current output of 1.0 mA, 0.1 ms and 2 Hz frequency, which was gradually reduced to 0.2–0.5 mA. The local anaesthetic solution (30 mL) was injected into all patients following negative aspiration, while maintaining the visible twitch of muscle groups in the forearm.

Patients in the lignocaine group (RL) received 20 mL 0.75% ropivacaine with 10 mL 2% lignocaine with adrenaline (1:200,000). Patients in the control group (RO) were given 20 mL 0.75% ropivacaine with 10 mL 0.9% saline. The final concentration of ropivacaine in the local anaesthetic solution was maintained at 0.5%. Completion of injection was considered as time-0, and the sensory block was evaluated using the pin prick method⁽⁴⁾ (score 0: sharp pain; score 1: touch sensation only; score 2: no sensation) at 2-min intervals from time-0 until complete sensory block was achieved. Onset time of sensory block (OTSB) was defined as the time interval (in mins) from time-0 to the time the sensory block started to be detected (i.e. score = 1). Time for complete sensory block (TCSB) was the time interval (in mins) from time-0 to the time complete sensory block was achieved (i.e. score = 2). Total duration of sensory block (TDSB) was the time interval (in mins) from the time complete sensory block was achieved to the time the score was < 2 . Total duration of analgesia (TDA) was taken as the time interval (in mins) between the time complete sensory block was achieved and the time of first analgesic request.

Motor block was evaluated using the Modified Bromage Scale⁽⁵⁾ (score 0: able to raise the extended arm at 90° for a full 2 s; score 1: able to flex the elbow and move the fingers, but unable to raise the extended arm; score 2: unable to flex the elbow, but able to move the fingers; score 3: unable to move the arm, elbow and fingers). Findings were recorded every 2 mins from time-0 until the complete loss of motor power. As with the sensory block, the onset time of motor block (OTMB) was

defined as the time interval (in mins) from time-0 to the time the motor block started to be detected (i.e. score ≥ 1). Time for complete motor block (TCMB) was the time interval (in mins) from time-0 to the time complete motor block was achieved (score = 3). Total duration of motor block (TDMB) was the time interval (in mins) between the time complete motor block was achieved and the time when the score was < 3 . Adequacy of the block was evaluated using the Allis clamp test.⁽⁵⁾

Heart rate, arterial blood pressure (systolic, diastolic and mean measurements) and arterial oxygen saturation were recorded every 5 mins from time-0 until the completion of surgery, and thereafter every 30 mins until recovery. Mild postoperative pain was treated with six-hourly IV paracetamol 1 g, while fentanyl 100 μg was added for moderate-to-severe pain. All patients were monitored until complete recession of motor and sensory blocks; the time to first analgesic requirement and the total analgesic dose administered were noted.

Sedation was assessed every 5 mins from time-0 until the end of surgery, and every 30 mins thereafter, with the use of the Sedation Scale⁽⁶⁾

(1: awakened and alert; 2: sedated, but responding to verbal stimulus; 3: sedated, but responding to mild physical stimulus; 4: sedated, but responding to moderate or strong physical stimulus; 5: not arousable). The sample size of the present study was determined according to the methodology described in previous studies.^(7,8) Results were presented as mean \pm standard deviation for parametric data and as percentages for nonparametric data. Data was analysed using standard statistical test softwares such as Microsoft Office Excel 2007 (Microsoft, Redmond, WA, USA) and IBM SPSS Statistics version 19.0 (IBM Corp, Armonk, NY, USA). Unpaired t-test was used to determine significant differences between the groups. A p-value of < 0.05 was considered

statistically significant and a p-value of < 0.001 was taken to be highly significant.

Results:

Among the patients in the RL and RO groups, no significant differences were observed with respect to the following factors: age, gender, height, weight and duration of surgery (Table I). No instances of failed blocks necessitating the administration of general anaesthesia were noted in any of the two patient groups.

The onset of sensory and motor blocks (Table 2) was earliest in the RL group (OTSB 3.84 ± 0.80 mins; OTMB 5.76 ± 1.05 mins); onset was significantly delayed in the RO group (i.e. the control group; OTSB 8.72 ± 1.13 mins; OTMB 10.08 ± 0.90 mins) ($p < 0.001$).

Similarly, complete sensory and motor blocks were achieved in a shorter duration of time in the RL group (TCSB 9.52 ± 1.33 mins; TCMB 14.32 ± 0.94 mins) compared to the RO group in which the achievement of sensory and motor blocks was significantly delayed in the RO group (TCSB 15.12 ± 1.42 mins; TCMB 19.52 ± 0.87 mins) ($p < 0.001$).

The total durations of the sensory and motor blocks (Table 3) were Comparable in both RL group (TDSB 238.04 ± 35.10 mins; TDMB 183.76 ± 26.73 mins) and RO group (TDSB 227.44 ± 36.27 mins; TDMB 172.64 ± 40.86 mins) ($p > 0.001$). TDA was also similar in the RL group (298.04 ± 27.06 mins) and RO group (297.04 ± 24.80 mins) ($p > 0.001$).

In the present study, three patients (two from the RO group and one from the RL group) had vessel injury, which was managed with pressure application. No haematoma formation was noted postoperatively.

Table 1: Demographic Data (Mean ± SD)

Group	A	B	p value
Age (yrs)	38.2 ± 15.74	42.64 ± 16.39	0.589
Weight (kg)	60.10 ± 7.58	60.56 ± 10.49	0.651
Height (cm)	161.02 ± 5.95	162.78 ± 7.42	0.265
Duration of surgery (min)	46.32 ± 38.03	58.52 ± 34.18	0.065

Table 2: Onset time and time required for complete block (minutes)

Group	Group-A	Group-B	p value
Onset time of sensory block (OTSB)	8.72 ± 1.13	3.84 ± 0.8	0.000
Onset time of Motor block (OTMB)	10.08 ± 0.90	5.76 ± 1.05	0.000
Time required for Complete Sensory Block (TCSB)	15.12 ± 1.42	9.52 ± 1.33	0.000
Time required for Complete motor Block (TCMB)	19.52 ± 0.87	14.32 ± 0.94	0.000

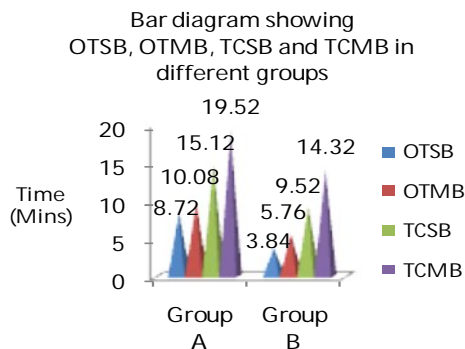
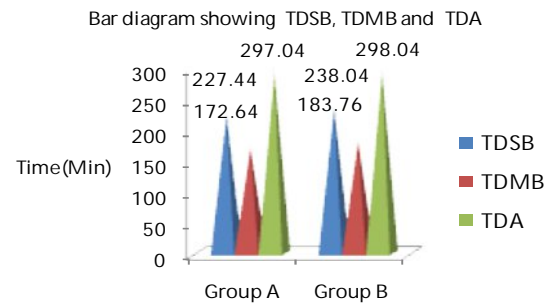


Table 3: Total duration of sensory, motor block and analgesia (minutes)

Group	Group-A	Group-B	p value
Total Duration of Sensory Block (TDSB)	227.44	238.04	0.282
Total Duration of motor Block (TDMB)	172.64	183.76	0.260
Total Duration of Analgesia (TDA)	297.04	298.04	0.892



Data is presented as no. (%). †Highly significant (i.e. p < 0.001). OTMB: onset time of motor block; OTSB: onset time of sensory block; RL group: group administered ropivacaine + lignocaine; RO group: group administered ropivacaine + saline (i.e. control group); SD: standard deviation; TCMB: time for complete motor block; TCSB: time for complete sensory block; TDA: total duration of analgesia; TDMB: total duration of motor block; TDSB: total duration of sensory block. SBP, DBP, MAP, RR, SpO₂, When compared were statistically not significant

Discussion:

In our study we have used nerve stimulator and this allowed us to use a volume of 30ml and a lower concentration of 0.5% ropivacaine as compared to many studies which have used a higher volume of local anaesthetic i.e. 40ml for brachial plexus block.

(3, 4, 5, 7) The use of nerve stimulator provides an objective end point to nerve location. This helps in use of lower volume and concentration of local anaesthetic which thereby reduces the incidence of local anaesthetic toxicity. Similar results were reported by Sardesai et al (2009).⁽⁹⁾ Ropivacaine produces lesser degree block in motor fibres and a faster onset in sensory fibres⁽¹⁰⁾, therefore it has been found to have marked differential sensory/motor blockade⁽¹¹⁾. Our study correlates with the above statement as the mean duration of sensory block was 227.44 ± 33.83 min and that of motor block was 172.64 ± 40.86 min in the plain ropivacaine group. This finding in our study strengthens the prediction of better differential block produced by ropivacaine. Our study findings indicate that 2% lignocaine with adrenaline when added to ropivacaine causes faster onset, and completion of both sensory and motor block. This is in accordance with study by Cuvillon et al who studied the pharmacodynamics and pharmacokinetics of mixtures of 2% lidocaine with long acting local anaesthetic in femoral and sciatic nerve blocks and found that mixture containing lidocaine induced faster onset of blocks. In their study the OTSB by ropivacaine 0.75% and 2% lignocaine mixture was about seven min faster as compared to ropivacaine alone.⁽¹²⁾ Similar results were seen in our study in which the onset time of sensory block in 2% lignocaine with adrenaline group was about 4.88 ± 0.33 min faster than the ropivacaine only group. OTSB in min was earliest in 2% lignocaine with adrenaline group 3.84 ± 0.8 min followed by clonidine group 5.84 ± 0.55 min and delayed in control group A 8.72 ± 1.13 min. The results were statistically highly significant. Our study showed that addition of 2% lignocaine with adrenaline to ropivacaine had no effect on duration of block and analgesia and this was in accordance with Hickey et al in 1990 who concluded that addition of epinephrine to ropivacaine 0.5% did not

effect the duration of block.⁽¹³⁾ The duration of block and analgesia in 2% lignocaine with adrenaline group was comparable to that in ropivacaine only group. There was decrease of systolic, diastolic and mean pressure in both the groups at different time intervals when compared with baseline values which was statistically not significant. Except for vessel injury in 3(4%) patients no other side effects and complications were noted. Kothari in the year 2003 reported 6% incidence of vessel puncture in supraclavicular brachial plexus block.⁽¹⁴⁾ Block in these patients could be performed successfully by redirecting the needle.

Conclusion:

Mixture of 0.5% ropivacaine and 2% lignocaine with adrenaline showed the faster onset of block without any effect on the duration of block and analgesia and differential sensory/motor blockade produced by ropivacaine would be well suited to orthopaedics because a good sensorimotor dissociation may facilitate rehabilitation and can be of particular benefit to the patient.

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