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Comparison Between 0.5% Levobupivacaine And 0.5% Ropivacaine for Ultrasound Guided Supraclavicular Brachial Plexus Block In Patients Undergoing Upper Limb Orthopaedic Surgeries

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Abstract | **Original Research Article**

Peripheral nerve blocks provide surgical anaesthesia and prolonged postoperative analgesia for upper limb surgeries. Compared to general anaesthesia, blocks provide sympathetic blockade, lesser incidence of PONV and cognitive disorders. Ultrasound guided supraclavicular brachial plexus block provides dense anaesthesia for surgeries of the forearm and hand. Brachial plexus is compact at supraclavicular region and pneumothorax as possible complication, can be eliminated by using US guidance. Many centres advocate this anaesthetic approach as gold standard for upper limb orthopaedic surgeries. Pharmacologically, Levobupivacaine is considered longer lasting than Ropivacaine. However, previous reports do not suggest a difference in analgesic effect when Levobupivacaine is used for brachial plexus blocks compared with ropivacaine, except for a single report. We compared 20mL 0.5% Levobupivacaine with 20mL 0.5% Ropivacaine when used for ultrasound guided supraclavicular brachial plexus nerve blocks in patients undergoing upper limb orthopedic surgery. A prospective comparative observational study involving forty patients aged 18-65years, ASA grade I & II, belonging to either sex divided into two groups, group L(n=20) and group R(n=20). Time of onset and duration of sensory and motor block, postoperative 2 hourly VAS scores, adverse effects were assessed. No significant difference in onset of sensory block (group L: 5.36±1.18min; group R: 5.74±1.25min; p>0.05) and motor block (group L: 7.11±1.07min; group R: 7.62±1.23min; p>0.05). Significantly longer duration of sensory block in group L (6.83±1.67hours) than group R (5.78±1.34hours), p=0.03 and significantly longer motor block in group L (6.13±1.14hours) than group R (4.35±1.56hours), p<0.001. VAS scores were comparable until 6hours post operatively, beyond that VAS scores were comparable but lower for group L. No adverse effects were seen. To conclude, Levobupivacaine produces longer onset and duration of sensory as well as motor block with better postoperative analgesia when compared with equal volume and concentration of Ropivacaine for ultrasound guided supraclavicular brachial plexus block.

Keywords: Ultrasound, supraclavicular, brachial plexus, Levobupivacaine, Ropivacaine, upper limb surgeries.

INTRODUCTION

Peripheral nerve blocks have the advantage of providing surgical anaesthesia along with prolonged postoperative analgesia for upper limb surgeries [1]. When compared to general anaesthesia, blocks provide sympathetic blockade, lesser incidence of PONV and cognitive disorders [2,3]. With the advent of USG imaging, vital structures in the supraclavicular region can be easily identified in real time along with optimum local anaesthetic spread. Thus, ultrasound technique has resurrected the supraclavicular approach for brachial plexus block which was long lost to oblivion. US guided supraclavicular brachial plexus block provides dense anaesthesia for surgeries of the forearm and hand [3]. The brachial plexus is compact at the level of supraclavicular region and hence provides dense and complete blockade of nerves, however at the cost of pneumothorax being a possible complication, which can be virtually eliminated by using US guidance as modality. Many centres advocate this approach as almost "the treatment of choice" for upper limb orthopaedic surgeries [4,5]. Levobupivacaine is the S-enantiomer of bupivacaine and is less cardiotoxic than racemic bupivacaine [6-9]. Ropivacaine is the S-

enantiomer of S-1-propyl-2, 6-pipecoloxylidide, is an amino-amide local anaesthetic with chemical structure similar to that of bupivacaine, it has less cardiotoxicity and neurotoxicity when compared to bupivacaine along with less motor blockade and similar sensory analgesia [6-9]. Reports suggest that Levobupivacaine has a longer duration of analgesia compared with Ropivacaine when used for spinal and epidural anaesthesia [10-13]. Levobupivacaine is more lipophilic compared with ropivacaine [14]. Pharmacologically, Levobupivacaine is considered more potent than ropivacaine with regard to providing postoperative analgesia. However, previous reports [15-17] have not shown a longer duration of postoperative analgesia when Levobupivacaine is used for brachial plexus blocks compared with ropivacaine, except for a single report [8]. Clinically, prolonged postoperative analgesia is important for postoperative pain management. We compare the effects of Levobupivacaine and ropivacaine when used for supraclavicular brachial plexus nerve blocks, performed under ultrasound guidance in patients undergoing upper limb orthopedic surgery procedures.

Aim & objectives

To compare the efficacy of 0.5% Levobupivacaine with 0.5% Ropivacaine for ultrasound guided supraclavicular brachial plexus block.

MATERIALS & METHODS

A prospective comparative observational study carried out between January 2018-November, 2018 in the operation theatre of Dr. Vikhe Patil Medical College & Hospital, Ahmednagar on patients requiring orthopaedic surgeries of the upper limb. A total of forty patients were enrolled for the study.

Inclusion criteria

1. Age 18-65 years.
2. ASA grade I & II.
3. Both sexes.

Exclusion criteria

1. Patients not willing/uncooperative
2. Known allergy to local anaesthetic
3. Coagulopathy
4. Infection at the site of block
5. Patients with peripheral neuropathy

Participants were allocated as per odd and even registration numbers into two groups of twenty patients each, labelled as group L (receiving 20mLs 0.5% Levobupivacaine) and group R (receiving 20mLs 0.5% Ropivacaine) for US guided supraclavicular brachial plexus block. Prior to the procedure, all patients had an IV line secured in opposite limb and routine standard monitoring as per the ASA was commenced along with baseline hemodynamic data charting. No analgesic or sedative premedication was administered to any patient. All necessary resuscitation equipment and drugs were kept standby. Patient was placed in supine position with the head tilted to opposite side of the block and adequate painting and draping done under all aseptic precautions. The linear ultrasound probe was chosen and sterility was maintained by meticulously cleaning the probe with ethyl alcohol. Sterile lignocaine 2% jelly was chosen as conduction medium between transducer and skin. Scanning was done with probe frequency set at 8-10MHz and depth 3cm, transducer was placed just above the clavicle in the coronal plane with the probe marker being lateral. After optimal probe placement, the first rib identified as hyperechoic line, above it the subclavian artery visualised as a round hypoechoic structure and just posterolateral to it were the hypoechoic nerve bundles of the brachial plexus arranged as cluster of grapes. Colour Doppler and pulse waveform modes were used to rule out any aberrant blood vessel lying in the field of injectate. For patient comfort, local infiltration of skin with 2% lignocaine was done just 2cm lateral to the probe, this would also be the entry point of the block needle. A 22-gauge 50 mm insulated needle (Stimuplex, Braun) was chosen to administer the drug. The needle trajectory was visualised by keeping the needle along the axis and as parallel to the probe surface as possible (in-plane technique). The needle tip was positioned satisfactorily within the sheath of plexus and drug deposited there after careful negative aspiration, a second injectate of remaining drug volume at the junction of the subclavian artery and the first rib was done to increase success of covering the ulnar nerve. Patient was assessed for loss of sensation to pin prick over the C5-T1 dermatomes using a three-point scale every thirty minutes.

- 0= normal sensation
- 1= reduced sensation
- 2= absent sensation

The onset of motor block was evaluated based on the modified Bromage Scale.

- 0= no paralysis
- 1= wrist flexion
- 2= elbow flexion
- 3= complete block

The onset of sensory and motor blocks was considered as time to reach scores of 1. In the postoperative period VAS scores were assessed every 2 hours till VAS was >4. Block was considered to have failed when sensory anaesthesia was not achieved within 30 minutes. General anaesthesia was given subsequently to these patients who were then excluded from analysis. Any complication such as pneumothorax, haematoma, tinnitus, circumoral numbness, dizziness and seizures was noted and documented. Surgical incision was allowed to begin 30 minutes after analgesia had been established.

Statistical analysis

Data was collected and statistically analysed using Microsoft Excel software. Student's unpaired t

test was applied for parametric data and chi-square test was used for categorical data. The confidence interval level was set at 95% and a statistical difference of <0.05 was considered significant.

RESULTS

Table-1: Demographic Variables

	Group L (n=20)	Group R (n=20)	P value
Age (years)	55.75 (23-64)	52.35 (24-62)	0.47
Male/Female	8/12	11/9	0.34
ASA I/II	7/13	5/15	0.49

All demographic variables were comparable between the two groups. Patients in group L had mean age of 55.75 years (Range: 23-64years) and those in group R had mean age 52.35 years (Range: 24-62 years). In group L, 8(40%) patients were males and 12(60%) females, whereas in group R, 11 (55%) patients were males and 9(45%) patients were females. As per ASA grade, in group L 7(35%) patients were of grade I and 13(65%) patients belonged to grade II. In group R, 5(25%) patients were grading me and 15(75%) patients belonged to grade II.

Table-2: Mean onset time of sensory and motor blockade

Onset (minutes)	Group L	Group R	P value
Sensory	5.36 ± 1.18	5.74 ± 1.25	0.32
Motor	7.11 ± 1.07	7.62 ± 1.23	0.17

The onset of sensory block in group L was 5.36 ± 1.18 min and in group R was 5.74 ±1.25min (p>0.05), thus comparable. Onset of motor blockade in group L was 7.11 ± 1.07 min and that for group R was 7.62 ± 1.23 min (p>0.05), again comparable.

Table-3: Mean duration of sensory and motor blockade

Duration (hours)	Group L	Group R	P value
Sensory	6.83 ± 1.67	5.78 ± 1.34	0.03
Motor	6.13 ± 1.14	4.35 ± 1.56	<0.001

The duration of sensory block was longer for group L at 6.83 ± 1.67 hours and for group R it was 5.78 ± 1.34 hours. (p<0.05), thus statistically significant. The duration of motor blockade was longer for group L at 6.13 ± 1.14 hours than group R was 4.35 ± 1.56 hours (<0.001), suggestive of a highly significant difference.

Table-4: Postoperative VAS scores

Time after surgery (hours)	Group L	Group R	P value
0	0	0	-
2	0	0	-
4	0	0	-
6	1.20 ± 0.32	1.24 ± 0.26	0.66
8	2.55 ± 0.48	2.75 ± 0.64	0.27

In the postoperative period, VAS scores for pain were calculated hourly till VAS was >4. And overall VAS scores were comparable in both groups till 0-6 hours, beyond 6 hours, the VAS scores were comparable but lower in Group L than in group R.

DISCUSSION

Peripheral nerve blocks have gained prominent role in modern anaesthesia armamentarium as they deliver ideal operative conditions without the need for general anaesthesia, thus curtailing any airway instrumentation and adverse effects. Other advantages are excellent perioperative analgesia that can be extended in to the postoperative period, avoidance of opioid related side effects, decreased recovery time and short hospital stay. Local anaesthetic agent choice, dose, volume, concentration and use of adjuncts govern the onset, extent, quality and duration of anaesthesia. Ropivacaine is reported to be less toxic than bupivacaine and is a potent blocker of A-delta and C fibres [18]. Levobupivacaine, S-enantiomer of bupivacaine has less cardiac and neural toxicity than bupivacaine, is currently the closest to the ideal agent for neural blockade.

Our study reveals a comparable onset time for sensory (group L: 5.36±1.18min; group R:5.74± 1.25min; p>0.05) and motor blockade (group L: 7.11±1.07min; group R: 7.62±1.23min; p>0.05) which was in conjunction with findings of Casati *et al.* [18]

who demonstrated that 30mL of 0.5% Levobupivacaine produced an inter scalene block of similar onset as produced by same volume of 0.5% Ropivacaine (20min; p=0.53), similar findings were reported by Liisanantti *et al.* [16]. Barsagade *et al.* [22] reported comparable onset time between Levobupivacaine and Ropivacaine(p>0.05). Nodulas *et al.* [19] reported both 0.5% Levobupivacaine and 0.5% Ropivacaine had similar onset of action for digital nerve block. Mageswaran R *et al.* [17], found the sensory and motor onset to be significantly faster in Levobupivacaine group (p=0.03). Kulkarni SB *et al.* [21], too noted a significantly earlier onset of sensory (p=0.027) and motor block (p=0.01) for Levobupivacaine. The onset time was quicker in our study compared to other studies because the drugs were deposited directly in the immediate vicinity of nerves under ultrasound guidance. An opposite trend observed by Mankad *et al.* [21] and Gonzalez *et al.* [24], found a faster onset of sensory and motor blockade for Ropivacaine than Levobupivacaine which was statistically significant (p<0.05). This could be attributed to the fact that most local anaesthetics block C fibres at the same rate but a fibre blockade depends on the physicochemical properties of the drug and also the difference in anatomical location of nerve blocks, the technique used.

The duration of sensory and motor blockade was significantly longer in Levobupivacaine group in our study then Ropivacaine (p=0.03 for sensory and p<0.001 for motor block). Similar observation was found in the study conducted by Cline *et al.* [8], Mankad *et al.* [20](p<0.05), Kulkarni SB *et al.* [21](p<0.001), Barsagade *et al.* [22] (p<0.001), found duration of motor and sensory blockade to be statistically significantly longer in Levobupivacaine group, however durations were varying in all studies due to different techniques and concentrations of drugs used.

In the postoperative period, VAS scores were analysed, scores were comparable until 6 hours postoperatively, beyond 6 hours the VAS scores were comparably lower in Levobupivacaine group at 6 hours (p=0.66) and at 8 hours (p=0.27). Kulkarni SB *et al.* [21] reported VAS scores to be comparable upto 7th hour postoperatively, but beyond that, Levobupivacaine group had significantly lower VAS than Ropivacaine group. Cline *et al.* [8], too reported lower VAS for Levobupivacaine after 8 hours postoperatively, but was comparable. Gonzalez *et al.* [23], reported higher VAS for Ropivacaine than Levobupivacaine at the time of first analgesic request.

In our study patients were monitored postoperatively for any untoward complications like circumoral numbness, tingling or allergic reactions, no complications were seen in our study groups.

CONCLUSION

From the present study, it can be concluded that for USG guided supraclavicular brachial plexus block, 20mL 0.5% Levobupivacaine produces a longer duration of sensory and motor blockade with better quality of analgesia postoperatively compared to 20mL 0.5% Ropivacaine. However, Ropivacaine produces early weaning off of motor blockade (thus early ambulation) at the expense of slightly inferior postoperative analgesia. Overall, Levobupivacaine offers better analgesia and hence lower cost of hospital stay and intravenous analgesic requirements.

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