Original Research Article

A comparative study to evaluate the effectiveness of 0.5% Levobupivacaine versus 0.5% Ropivacaine in Axillary Brachial plexus block

Gopal Lal Bansal[1], Neelu Sharma[2],Rajneesh Kumar Singhal[3],Laxmi Agrawal[4*]

[1,3]Assistant Professor, Department of Anaesthesia, SMS Medical College, Jaipur, Rajasthan, India
[2]Associate Professor, Department of Anaesthesia, SMS Medical College, Jaipur, Rajasthan, India
[4]Senior Resident, Department of Anaesthesia, SMS Medical College, Jaipur, Rajasthan, India

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Abstract

Objective: Levobupivacaine and Ropivacaine having better pharmacological profile in respect of less cardiac and neurological toxicity in comparison of Bupivacaine on accidental intravascular injection. Present study is aimed to compare onset and duration of sensory, motor blockade and analgesia between groups receiving axial plexus block with 0.5% Levobupivacaine/Ropivacaine. **Methods:** This randomized study included 50 patients of ASA grade I, II, age of 18-65 years of either sex undergoing surgery for forearm and hand. Group L/R received 0.5% Levobupivacaine/Ropivacaine 40ml respectively through axillary brachial plexus block. The onset of sensory and motor block and duration of sensory/motor block and analgesia were recorded. Vital parameters were recorded in intraoperative and postoperative period. **Result:** Time to onset of sensory and motor block was significantly faster in group R as compared to group L. The mean duration of analgesia in group L was 674.04 ± 82.89 minutes and group R was 513.68 ± 20.14 minutes(p value < 0.001), showing significantly longer duration of analgesia with levobupivacaine . The mean duration of motor block in group L/R was 622.96 ± 99.74 and 407.80 ± 20.72 minutes respectively (p value < 0.001). No clinically significant difference in vital parameters was noted. **Conclusion:** Onset of sensory and motor block was significantly faster with ropivacaine than levobupivacaine, but duration of analgesia and motor block was significantly prolonged with levobupivacaine hence suggesting levobupivacaine a better choice in axillary block to address the need of longer postoperative analgesia and motor block.

Key words: Axillary block, Levobupivacaine, Ropivacaine.

Introduction

Brachial plexus block is an invaluable and alternative approach to general anaesthesia for upper limb surgeries in account of safety and low risk specially in chronic diseases like diabetes mellitus and cardio- pulmonary disease. When compared to general anaesthesia, it provides ideal operating conditions, adequate muscle relaxation and stable intraoperative haemodynamics[1,2] as well as devoid of complications of general anesthesia like vomiting and aspiration in emergent conditions like full stomach[3].There are various approaches for brachial plexus block in which axillary approach is one of the most popular because of its relative ease , reliability and safety [(4)]. Bupivacaine is the most commonly used drug for brachial plexus block but associated with significant cardiotoxic and neurotoxic side effects on accidental intravascular injection .[(5)] Levobupivacaine (S-enantiomer of bupivacaine) and Ropivacaine (pure S (-) enantiomer of propivacaine) are safer in this regard ,hence we evaluated the effectiveness of levobupivacaine 0.5% versus ropivacaine 0.5% in axillary block in surgeries of upper limb below elbow joint. The primary aim of our study was to assess and compare the onset and duration of sensory and motor block while the secondary aim was to observe any comparable undesirable effect of the drugs used if any .

Method

After approval from Institutional Ethical Committee, we conducted this prospective, randomised, double blinded study. After obtaining written and informed consent from patients, we included 50 patients of ASA grade I and II, between age of 18-65 years of either sex undergoing surgery for forearm and hand.

*Correspondence
Dr. Laxmi Agrawal
Senior Resident, MBBS, MD(Anaesthesia), SMS Medical College, Jaipur, Rajasthan, India.
E-Mail: drlaxmi.agrawal11@gmail.com

Exclusion criterias were local infection, deformity of limb, severe systemic disease, neurological disease, coagulopathy and allergy to study drugs. Patients were randomised using computer generated random number table and allocated to a study group using sealed opaque envelope. Group L received 0.5% Levobupivacaine 40 ml and Group R received 0.5% Ropivacaine 40 ml. Before shifting the patient in OT, fasting status, pre anaesthetic checkup and consent were checked. After taking the patient on OT table, all routine monitors like Vital parameters [Heart rate(HR),non-invasive blood pressure(NIBP), respiratory rate(RR)] SPO_2, ECG were attached and baseline parameters were recorded. Intravenous access was taken with 18G/ 20G cannula. Patients were positioned supine with arm abducted and elbow flexed to 90 degree with head turned to contralateral side by 30 degree. Axillary artery was palpated at the maximum point of impulse and was marked with the help of marker pen. After taking all aseptic precaution, 22G 1.5 inch sterile needle was advanced from the mark site until paraesthesia was elicited. Further advancement of the needle was stopped and drug according to assigned group was injected after negative aspiration.Patients were assessed for onset of sensory block every 1 minute by pin prick with 25 gauge needle in all the dermatomal areas corresponding to all four nerves (radial, median, ulnar and musculo-cutaneous nerve). Sensory block was graded as-Grade 0- Sharp pain, Grade 1 -Touch sensation only, Grade 2 -Not even touch sensation. Onset of sensory block was the time from placement of brachial plexus block till loss of sensation of pin prick sensation while duration of analgesia was the time from placement of brachial plexus block till patients requires first dose of rescue analgesia. Assessment of motor block was carried out at each minute. Motor block was determined according to a modified Bromage scale[5,6] of upper limb extremity on a 3-points scale. (Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers; Grade 1: Decreased motor strength with ability to move the fingers only; Grade 2: Complete motor block with

inability to move the fingers). Onset of motor blockade was considered when there is Grade 1 motor blockade. Peak motor block was considered when there is Grade 2 motor blockade. Duration of motor block was from placement of brachial plexus block to patients to achieve Bromage score 1.The assessment was made every one minute up to 15 minute than every 15 minute till 1 hr or till completion of surgery and thereafter every 2 hourly. Duration of surgery was noted and post operative monitoring was done every 2 hour till next 6 hours and 4 hours after complete recovery from sensory block. Pain was assessed using a 0 to 10 verbal numeric rating scale (NRS). Hemodynamic parameters were recorded before the axillary block and 30 minutes,1,2,3,6 and 9 hours after surgery.

Statistical analysis

The comparison between the two groups with respect to demographic variables was done by unpaired t-test. Intraoperative H.R., BP, RR was analysed by using unpaired t-test. The onset and duration of sensory and motor blocks were compared between two groups using unpaired t-test. Difference was considered significant if the p value<0.05 .

Results

After studying 50 cases, the observation and results were summarized in demographic variables (Table 1) and haemodynamic variables (Table 2). Both the groups were found comparable with respect to age, gender distribution,weight and duration of surgery.

Table 1: Comparison of demographic and other relevant parameters at baseline between the groups

Variables	Group L (Mean ± SD)	Group R (Mean ± SD)	P value
Age (years)	37.76±12.72	34.28±12.10	>0.05
Gender (M/F)	14/11	16/9	
Weight (kg)	65.56±10.30	65.76±9.07	>0.05
Duration of surgery (minutes)	71.40±26.52	71.28±26.74	>0.05

Table 2: Comparison of haemodynamic and respiratory parameters between the groups

S.No.	Time interval minute	Pulse (/min)		SYSTOLIC BLOOD PRESSURE (SBP) (mmHg)		RR (/min)	
		Group L	Group R	Group L	Group R	Group L	Group R
1	Baseline	81.60±7.08	83.64±8.22	126.00±7.64	128.64±8.30	17.48±1.23	17.56±1.19
2	5	88.48±6.07	89.12±4.91	129.84±6.19	131.88±6.22	18.96±1.37	19.24±1.22
3	15	83.96±5.93	82.96±6.45	124.36±6.58	125.04±9.65	18.68±1.41	18.84±1.14
4	30	80.96±5.01	80.72±2.94	128.44±6.22	128.96±2.65	16.88±0.67	17.04±0.54
5	60	80.52±2.50	80.46±2.00	122.64±7.18	124.52±2.31	16.96±0.93	17.16±0.37
6	120	82.20±5.45	81.92±3.15	122.64±6.08	124.24±4.29	17.72±1.14	17.72±1.34
7	240	81.60±5.26	81.92±3.45	122.96±6.93	123.68±3.45	17.12±0.83	17.12±1.24
8	480	80.88±3.28	80.64±2.81	122.56±6.26	122.36±3.20	17.96±0.45	18.04±0.20
9	>480	81.76±3.42	81.58±2.72	126.72±4.28	128.40±2.52	17.28±0.79	17.16±1.18

P value between both the groups was consistently > 0.05 with regard to HR, SBP, and Respiratory rate at various time intervals .

When characteristics of blockade was assessed between the groups, we found that onset of sensory and motor block was significantly faster in ropivacaine group but duration of analgesia and motor block were significantly more in levobupivacaine group. (Table 3)

Table 3: Onset and duration of analgesia and motor block {mean + SD}

Parameters	Group L	Group R	p value
Onset of sensory block(minutes)	15.20 ± 3.04	10.64 ± 2.63	<0.001*
Onset of motor block (minutes)	11.12 ± 2.99	7.32 ± 2.36	<0.001*
Duration of analgesia (minutes)	674.04 ± 82.89	513.68 ± 20.14	<0.001*
Duration of motor block (minutes)	622.96 ± 99.74	407.80 ± 20.72	<0.001*

Discussion

Brachial plexus block is a cost effective and very good alternative to provide anaesthesia and analgesia and avoiding airway instrumentations and general anaesthesia related complications like aspiration, delayed postoperative recovery and patients dissatisfaction There are various technique to block brachial plexus among them axillary plexus block is best, in term of finding in landmarks and avoiding complications like pneumothorax and phenic nerve injury[4] and method of choice[7-9]for surgeries of upper arm below elbow joint. Both levobupivacaine and ropivacaine are commonly used to provide long-lasting analgesia after peripheral nerve block Ropivacaine is a long acting amide local anaesthetic agent with potentially improved safety profile when compared with bupivacaine. Human trials have demonstrated less cardiac depression and fewer CNS side effects when ropivavcaine in injected intravenously suggesting potential clinical advantage of this drug during neural blockade when large volume of local anaesthetic is required[9]. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres.Therefore, it has selective action on the pain-transmitting A β and C nerves rather than Aβ fibres, which are involved in motor function, resulting in a relatively reduced motor blockade[9]. Levobupivacaine, the S (−) isomer of bupivacaine, has emerged as an option that could offer similar intensity and duration of block as bupivacaine but also with a safer toxicity profile owing to its faster protein binding rate. It is essential to establish an undisputedly better efficacy of ropivacaine versus levobupivacaine owing to economic reasons too as ropivacaine is almost five times costlier than levobupivacaine. Moreover according to few studies Levobupivacaine provides comparatively longer-lasting analgesia from epidural and spinal injections and a more potent analgesic effect in postoperative period.Present study was performed to compare efficacy of 40 ml of 0.5 % Levobupivacaine versus 0.5 % Ropivacaine in axillary brachial plexus block in patients undergoing surgeries of arm below elbow joint. Both the groups were comparable in terms of age, gender distribution, ASA class and duration in which surgery performed. There are gross variations in various research articles regarding onset time of sensory and motor block when levobupivacaine and ropivacaine compared. The mean onset time of sensory block and motor block was significantly shorter in ropivacaine group compared to levobupivacaine group (p<.001) in our study . Similar results were observed by Rathore A et al and González- Suárez et al[13] Ropivacaine has elective action on nociceptive (Aδ and C fibers) than on motor fibers, which might give rise to a faster onset of sensory block for ropivacaine owing to its 10 times less lipophilicity than levobupivacaine and it easily induces local vasoconstriction in tissues surrounding the injection site[14]However, Nodulas et al[15] and Liisanantti O et al[16] and found that both 0.5% Levobupivacaine and 0.5% ropivacaine had similar onset of action. While Kulkarni et al[5]and Deshpande et al[17] found that statistically significant mean time to onset of

sensory and motor blockade was observed earlier in group of patients received levobupavacaine compared to patients received ropivacaine. Although mostly published literature is in accordance with our study, in view of this discrepancy we recommend that , a more comprehensive study is needed to evaluate more number of patients for a more extended period of time. When we compared mean duration of analgesia and motor block ,we observed them to be significantly longer in levobupivacaine group as compared to ropivacaine group ($p < .001$). Contrary to variable findings in terms of onset time, consistent results are found in literature regarding duration of analgesia, duration of sensory as well as motor block. Results of study by Kulkarni SB et al, Casati A et al[18] and Cline et al[19] were similar to our study in this regard. Deshpande et al [15] and Rathore A et al also found that the duration of sensory and motor block were prolonged when compared to 0.5% ropivacaine in supraclavicular brachial plexus block.Thus return of motor activity was significantly faster in the ropivacaine group. A metaanalysis by Ang Li et al also cocluded that Levobupivacaine provided more long-term anesthesia and significantly lower incidence of postoperative rescue analgesia than ropivacaine supporting results of our study. [20]

Most of the clinical researches suggested that levobupivacaine was slightly less potent than bupivacaine but more potent than ropivacaine. Higher potency of levobupivacaine than ropivacaine was explained by various mechanisms in literature like greater lipid solubility of levobupivacaine,(differences in molarity due to apparent differences in molecular weight and presentation as a hydrochloride salt or a base, difference in MLAC of local anaesthetics { 0.083% (levobupivacaine) and 0.081% (bupivacaine) separately, with approximately 50% higher for ropivacaine} and the difference in clinical factors such as block technique and magnitude of operations [19-21].Regarding intra operative and postoperative haemodynamic parameters ,we found that heart rate(HR), systolic blood pressure(SBP), diastolic blood pressure (DIBP) and respiratory rate(RR) were comparable in both the groups at various time intervals ($p>0.05$). Deshpande et al[13] also observed that there was no significant difference between both the groups regarding heart rate and blood pressure. The same findings were also observed by Kulkarni et al.[5]We also monitored patients postoperatively for any complications like hypotension, bradycardia, paraesthesia, nausea ,vomiting and allergic reactions . No complication was reported at the dosages we used in our study. Thus, in our view levobupavacaine provides longer duration of analgesia with a prolonged motor blockade in comparison to ropavacaine.

Conclusion

From our study, conclusion was drawn that onset of sensory and motor block was significantly faster with ropivacaine than levobupivacaine but duration of analgesia and motor block was significantly prolonged with levobupivacaine. Hence both the drugs are good choice for axillary brachial plexus block with less cardiotoxicity and neurotoxicity but levobupivacaine should be considered when postoperative analgesia is a concern. Ropivacaine ensures ealy return of motor function.

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