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Comparasion Of 0.5% Ropivacaine And 0.5% Bupivacaine in Supraclavicular Brachial Plexus Block For Upper Limb Surgeries

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Abstract
Background & Objectives: *Ropivacaine, a new local anaesthetic, has been recently introduced into clinical practice because of its lower toxic effects for heart and central nervous system. It has been already investigated in and local-regional techniques.evaluate the clinical efficacy of 0.5% ropivacaine for supraclavicular bronchial plexus block for upper limb surgeries and comparing it with 0.5% bupivacaine in terms of characteristics of supraclavicular blockade and side effects.*
Methods: *The design was a prospective double blind randomized study enrolling 60 patients of either sex, ASA I and II, were randomly allocated into two groups in which supraclavicular brachial plexus block was performed using 35ml of ropivacaine 0.5% and bupivacaine 0.5% respectively. The onset and duration of sensory and motor block and possible side effects were recorded.*
Results: *Ropivacaine had earlier onset of sensory and motor blockade compared to bupivacaine. The duration of sensory and motor blockade was longer in group of patients treated with ropivacaine than in bupivacaine group. No statistically significant difference was found in quality of blocks in both groups. There were no side effects observed in the study.*
Conclusions: *Ropivacaine 0.5% can be safely used as an alternative to bupivacaine 0.5% in supraclavicular bronchial plexus block.*
Keywords: *Ropivacaine, Bupivacaine, Supraclavicular brachial plexus block, Sensory and motor blockade.*

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I. Introduction

Supraclavicular brachial plexus block via **Winnie's** approach is a very popular mode of anaesthesia for various upper limb surgeries. This approach is attractive due to its effectiveness in terms of cost and performance, margin of safety along with good postoperative analgesia. With the introduction of newer and safer local anaesthetics and better advantages, regional anaesthesia has taken over as the principle technique for upper limb surgeries. Upper extremity regional anesthesia has been a mainstay of the anesthesiologist's armamentarium since **Hall**[8] first reported the use of cocaine to block the brachial plexus in 1884. Orthopedic and plastic reconstructive surgeries may turn out to be of prolonged duration, hence adequate sensory and motor blockade along with profound analgesia are the main requirements for such surgeries. Various approaches to brachial plexus block is performed where the brachial plexus is presented most compactly at the distal trunk/proximal division level, this compactness may explain the block's historical reputation for providing short latency and complete, reliable anesthesia for upper extremity surgery. Variety of local anesthetics can be used to perform ideal and complete block. Among them, bupivacaine provides a longer duration of action, but at high doses it may lead to cardiotoxicity and neurotoxicity, the cardiotoxicity may be life threatening as the dysrhythmias that are produced are resistant to all routinely used antiarrhythmics. Hence, there is a need for a drug which can have all the advantages of bupivacaine without its cadiotoxicity. Ropivacaine is a new amide local anaesthetic that has been shown in animal studies to be similar to bupivacaine in terms of onset and duration of brachial plexus block. In human brachial plexus studies, ropivacaine 0.5% with or without epinephrine has been shown to provide effective sensory and motor block of prolonged duration. The toxicity of ropivacaine has been reported to be less than that of bupivacaine.

II. Methods

This prospective randomized double blind study included total 60 patients belonging to ASA grade I and II of either sex with the age between 18-60 years and weight between 40 to 80 kgs. Exclusion criteria included known patient refusal, allergy to local anaesthetics, local infections, bleeding disorders, coagulopathy,

mental illness and patients on anti-arrhythmic drug after approved by the ethical committee of the institution. Each patient visited pre-operatively and the procedure explained and written and informed consent was taken. Complete blood count, blood grouping, blood sugars, bleeding time, clotting time, blood urea, serum creatinine, serum electrolytes (Sodium, potassium, chloride), chest x-ray, and ECG were done. Patients were randomly allocated by simple randomization into two groups of 30 each (85% power).

Group B – i.e. Bupivacaine group receive ing 35mL Bupivacaine 0.5% (5mg/mL).

Group R – i.e. Ropivacaine group receiving 35mL Ropivacaine 0.5% (5mg/mL).

All the patients were pre-medicated with tablet alprazolam 0.5mg overnight and the morning of surgery. All the necessary equipments and drugs needed for administration of general anesthesia were kept ready in order to manage failure of block. Intravenous access obtained in the limb opposite to that undergoing surgery with a large bore IV cannula. After connecting the routine pre-induction monitors, baseline values of systolic and diastolic blood pressure, heart rate, oxygen saturation were recorded. Patient was placed in supine position with the head turned away from the side to be blocked. Arm to be anaesthetized adducted and extended towards the ipsilateral knee as far as possible. Supraclavicular area aseptically prepared and draped. An intradermal wheal raised about 1cm above the mid-clavicular point. Subclavian artery palpable in supraclavicular fossa used as landmark. A 23-gauge needle inserted behind the artery in backward- inward-downward direction till paresthesia in the forearm elicited. After negative aspiration for blood, 35mL of respective drug was injected.

Sensory block was assessed by pinprick every 3 min in the C5-C6 determatomes. Motor blockade was assessed using Modified bromage scale. Failure to lose shoulder abduction after 30 min was considered to be block failure and hence general anaesthesia was given and patient was excluded from study. All episodes of local anaesthetic toxicity or hemodynamic changes requiring anesthesiologist intervention were recorded as adverse events. After evidence of successful motor and sensory block surgery was performed. In case of prolonged surgeries, general anaesthesia was administered as the effect of brachial plexus block seemed to be weaning off (patient complains of pain at the site of operation). Various parameters like HR, systolic and diastolic blood pressure, onset and duration of sensory and motor block, quality of block and complications if any were noted during and after the procedure every 3 min for the first 30 min and then every 10 min there after till the end of surgery.

Postoperatively patients were monitored every hourly for 12 hours, then after 12 hours patients were shifted to ward and they were asked to note the time of requirement of first rescue analgesic, complications in the form of neurotoxicity were assessed.

Statistical analysis

Demographic variables, duration of surgery hemodynamic parameters, onset and duration of sensory and motor block and time interval for the first rescue analgesic were expressed as mean±SD. This data were compared in two groups and differences in means were inferred by unpaired‘t’ test. A ‘P’ value <0.05 was considered statistically significant.

III. Results

A total of 60 patients who underwent elective or emergency surgical procedure were enrolled for the study and were randomly allocated into 2 groups of 30patients each. In Group, R (Ropivacaine) 80% patients were males and 20% patients were females. While in Group B (bupivacaine), 80% patients were males and 20% patients were females. The demographic profiles, hemodynamic parameters of the patients and mean duration of surgical procedures were comparable between two groups and difference was statistically not significant, (Table 1).

Table 1: Demographic data, duration of Surgery and Hemodynamic parameters

Variables	Group R	Group B	P- Value
Age (Years)	37.83+/- 10.05	41.00+/- 10.82	0.245± (NS)
Weight (Kgs)	58.83+/- 06.39	58.40+/- 04.27	0.759± (NS)
Surgery duration (hrs)	03.23+/- 0.82	03.07+/-0.74	0.411± (NS)
M/F	40/10 (80%/20%)	40/10 (80%/20%)	1.00 ± (NS)
ASA Physical Status	39/11 ± (785/22%)	38/12 ± (76%/24%)	0.50 ± (NS)
HR (Beats/minute)	79.82 ± (12.26)	81.38 ± (13.70)	0.55 ± (NS)
Systolic BP (mmHg)	130.34 ± (8.94)	127.18 ± (7.96)	0.07 ± (NS)
Diastolic BP (mmHg)	81.48 ± (10.82)	81.54 ± (8.94)	0.98 ± (NS)

Observations regarding nerve blockade were made and compared between two groups. Onset of sensory blockade was significantly faster in group R than Group B at C-5 and C-6 ($p < 0.05$). No statistically significant difference was found between two groups in regards to quality of sensory block, ($p > 0.05$). Motor

block onset was seen faster in group R than in group B and which was statistically significant. The maximum duration of sensory blockade was found for group R with mean of 9.03±1.38 hours whereas it was 7.18±1.08 hours for group B. The duration of motor blockade was longer in group R (7.53±41.22 hours) as compared to group B (6.62±1.01 hours), ($p < 0.05$). There was no statistically significant difference observed in quality of sensory and motor blockade in both groups. Table 2 shows the comparisons of characteristics of supraclavicular blockade and time of requirement of first rescue analgesic.

Table 2: Summary of results regarding characteristics of Supraclavicular blockade.

Characteristics	Group R	Group B	P- Value
Onset of sensory block (Min)	4.93+/- 1.78	8.47+/-2.50	0.000
Onset of motor block (Min)	10.63+/- 2.92	18.80+/- 3.71	0.000
Quality of sensory block	4.00+/- 0.00	3.93+/-0.25	0.155
Duration of sensory block (Hrs)	9.03+/- 1.38	7.18+/- 1.08	0.000
Duration of motor block (Hrs)	7.53+/- 41.22	6.62+/- 1.01	0.002
Time interval for requirement of first rescue analgesic (Hrs)	14.40+/- 2.13	11.60+/-1.81	0.000

The time interval for requirement of first rescue analgesic was no longer in group R than group B. the number of patients requiring first dose of rescue analgesic were significantly more in group B (37%) than in group R (3%) within 8-10 hrs.almost all the patients in group B required rescue analgesia within 14 Hrs while in group R around only 55% patients required rescue analgesia within 14 Hrs.there was no statically difference between two groups in terms of heamodynamic parameters at different time intervals till 12 hrs if administration of brachial plexus block.There was no evidence of any side effects or any signs of CNS toxicity, CVS toxicity or any allergic drug reaction.

IV. Discussion

In present study use of brachial plexus were preferred to block for the patients undergoing upper extremity surgeries. It is well accepted component of comprehensive anaesthesia care and of great value particularly in the patients who are poor risk for surgery and in emergency situations where patients are with full stomach and prone for aspiration. It provides excellent anaesthesia without loss of consciousness and protective airway reflexes. Anaesthesiologists opt for familiar approaches of brachial plexus anaesthesia such as interscalene, supraclavicular and axillary. However each has its own limitations and complications. But supraclavicular approach has been considered the most efficacious approach to brachial plexus block because in this approach we block the trunks of brachial plexus.[8] It is often called as spinal anaesthesia for upper extremity because of its ubiquitous application for upper extremity surgery characteristically associated with a rapid onset of anaesthesia, high success rate, complete and predictable anaesthesia for entire upper extremity. The patient's cooperation is very much essential for appreciating paresthesia to locate the nerve plexus. Many authors have studied different concentrations of ropivacaine that is 0.25%, 0.5%, 0.75% and 1% and compared them with 0.5% bupivacaine in different studies. It was found that 0.5% ropivacaine is safer and adequate for brachial plexus block. Different studies found that 0.5% ropivacaine was as equipotent as 0.5% bupivacaine in providing adequate brachial plexus block. **Klein N S et al**[13] and **Bertini et al**[4], in their studies of increasing concentration of ropivacaine from 0.5% to 0.75% failed to improve onset and duration of the interscalene brachial plexus block. However **Casati et al**[6] reported that ropivacaine was suitable and safe local anesthetic for brachial plexus block at a dose of 2.5-2.6 mg/kg without any adverse effects. On the basis of literature review, the present study utilizes same concentration (0.5%) and volume (35ml) of ropivacaine and bupivacaine. Special care was taken while injecting the solution with repeated negative aspirations to prevent inadvertent intravenous injection. Using 35 ml of 0.5% ropivacaine with the average dose of 2.55 mg/kg, none of the patients developed any features of CNS or CVS toxicity in ropivacaine group; we can say that 0.5% ropivacaine can be used as a local anesthetic at a dose of 2.5mg/kg safely in supraclavicular brachial plexus block.

There was no significant difference between two groups with regards to the demographic profile (age, sex, weight) and duration of surgery. In our study onset of sensory block was defined as time elapsed from injection of drug to complete loss of cold perception of upper limb as elicited by using spirit soaked cotton or pinprick. Whereas onset of motor block was defined as time elapsed from injection of drug to complete motor block elicited by asking the patient to abduct the shoulder, flex the forearm and hand against gravity. The difference in the onset of sensory and motor blockade in both the groups was found to be statistically significant, ($p < 0.05$). Similar results were observed in a study conducted by **Ana A et al**[3]**. Bertini et al**[4] reported that the mean peak time for the complete sensory and motor blockade was found to be shorter with different concentration of ropivacaine than bupivacaine.[12] Most of the other studies found no statistically significant difference in onset of sensory and motor blockade with 0.5% ropivacaine and 0.5% bupivacaine. In the study duration of sensory blockade was defined as time elapsed between injection of the drug and return of the pin prick sensation. longer duration of sensory block with ropivacaine than bupivacaine was found in

supraclavicular block. Duration of motor blockade was defined as time between drug injections to complete return of motor power with movement of all upper limb joints. It was observed that ropivacaine when compared with bupivacaine shows longer duration of motor blockade with no difference in quality of motor blockade. The results regarding the motor blockade were agreement with various studies. There was no significant statistical difference observed in quality of sensory and motor blockade in both groups. Similar results were found in the different studies.

The time interval between administrations of supraclavicular block to the time of first rescue analgesic (VAS >3) was measured. Injection diclofenac 75 mg IV was given if the VAS >3. Difference of time interval was found to be statistically significant, suggesting that ropivacaine provides analgesia for longer duration than bupivacaine. The number of patients requiring first dose of rescue analgesic were significantly more in group B (37%) as compared to group R (3%) within 8-10 hours. Almost all the patients in group B (100%) required rescue analgesia within 14 hours while in group R around only 55% patients required rescue analgesic within 14 hours. No changes were observed in pulse rate, mean arterial pressure or oxygen saturation throughout the study and which was statistically not significant.

No side effects were noted in any of the patients in any group, no signs of CNS toxicity (like restlessness, anxiety, incoherent speech, lightheadedness, dizziness, blurred vision, tremors, drowsiness and convulsion) or CVS toxicity (hypotension, bradycardia, hypertension.tachycardia, vasovagal reaction, arrhythmias like extrasystoles, atrial fibrillation, ST segement changes and myocardial infarction), severe allergic reactions (rash, itching, difficulty breathing, tightness in the chest, swelling of the mouth, face, lips or tongue) nausea, vomiting, pneumothorax noted in any patient in any group. There was complete resolution of nerve block and no signs of any neurological dysfunctions noted upto 72 hours in any patients.

V. Conclusion

Ropivacaine at the concentration of 0.5% can be safely used as an alternative to bupivacaine as long acting local anesthetic in supraclavicular brachial plexus block. The study suggest that 0.5% ropivacaine because of its structural properties was associated with less CNS, CVS toxicity, local neurotoxicity, faster onset of sensory and motor blockade; longer duration of analgesia and anaesthesia with similar quality of block as 0.5% bupivacaine. It also has an added advantage of prolonging the requirement of first rescue analgesic in post operative period than bupivacaine.

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