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30ml 0.5% isobaric levobupivacaine over 30ml 0.5% bupivacaine used for interscalene brachial plexus block: Haemodynamic parameters

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Abstract
The primary cardiac electrophysiologic effect of local anaesthetic is a decrease in the maximum rate of depolarization in the purkinje fibres and ventricular muscle. This is due to a decrease in the availability of sodium channels. Action potential duration and the effective refractory period is alsodecreased. Sixty patients aged between 18yrs and 60yrs of physical status ASA grade 1 and ASA grade 2 undergoing elective upper limb surgeries were included in the study after ethical clearance from the college ethical committee. Each patient was visited pre-operatively and the procedure explained and written informed consent was obtained. The systolic blood pressure measurement done at various time intervals did not show any statistically significant difference (p>0.05) between the two groups. The diastolic blood pressure measurement done at various time intervals show no statistical difference between the two groups (p>0.05).

Keywords: isobaric levobupivacaine, bupivacaine, haemodynamic parameters

Introduction
Local anesthetics prevent the transmission of nerve impulses (conduction blockade) by inhibiting the passage of sodium ions through ion-selective sodium channels in nerve membranes. The sodium channel itself is a specific receptor for local anaesthetic molecules. The failure of sodium ion channel permeability to increase slows the rate of depolarization so that the threshold potential is not reached and thus an action potential is not propagated. Local anesthetics do not alter the resting trans membrane potential or threshold potential [1, 2].
The primary cardiac electrophysiologic effect of local anaesthetic is a decrease in the maximum rate of depolarization in the purkinje fibres and ventricular muscle. This is due to a decrease in the availability of sodium channels. Action potential duration and the effective refractory period is alsodecreased. The depression of rapid phase of depolarization (V-max) in purkinje fibres and ventricular muscle by Bupivacaine is far greater compared to Lignocaine. Also the rate of recovery of block is slower with Bupivacaine [3]. Therefore there is incomplete restoration of V-max between action potential particularly at higher heart rates. Therefore, Bupivacaine is highly arrhythmogenic. The cardiac contractility is reduced, this is by blocking the calcium transport.
Levobupivacaine due to its stereoselective properties, contributes to having a significantly higher threshold for cardiotoxicity and CNS toxicity than bupivacaine in healthy volunteers [4]. Levobupivacaine demonstrated less affinity and strength of inhibitory effect onto the inactivated state of cardiac sodium channels than the racemic parent in *in vitro* animal tissue experiment studies. It showed less depressant effect on the atrioventricular conduction and QRS complex duration [5].
The Central Nervous System effects occurs earlier than cardiotoxic symptomsduring an intravenous (IV) infusion of local anaesthetic. The uptake of bupivacaine by the central nervous cells is enantioselective. In anaesthetized rats receiving arrhythmogenic intravenous doses of levobupivacaine or dextrobupivacaine showed aless rapid blockade of the cell firing in the nucleus tractus solitarius after levobupivacaine than after dextrobupivacaine. All animals receiving dextrobupivacaine developed apnea and died whereas those receiving levobupivacaine continued to breathe and all but two survived [6].

Methodology

Type of study: Prospective Study
Study Design: Randomised Clinical Study
Sample Size: Two groups of 30 each.

We hypothesized that onset of sensory block with levobupivacaine is slower compared to bupivacaine. Sample size was calculated keeping two sided alpha error at 5% and power at 80% minimum of 29 patient in each group is required to detect a minimum of 2 min difference in onset of sensory block between two groups. For better validation 30 patients are selected in each group.

Sixty patients aged between 18yrs and 60yrs of physical status ASA grade 1 and ASA grade 2 undergoing elective upper limb surgeries were included in the study after ethical clearance from the college ethical committee.

Each patient was visited pre-operatively and the procedure explained and written informed consent was obtained. Complete blood count, blood grouping, blood sugar, bleeding time, clotting time, blood urea, serum creatinine, serum electrolytes (sodium, potassium, chloride), chest x-ray, ECG were done as institutional protocol. All patients were pre-medicated with tablet alprazolam 0.5 mg overnight of surgery.

Inclusion Criteria

- Patients aged between 18yrs and 60yrs
- Physical status ASA grade 1 and ASA grade 2
- Patients weighing more than 50kg
- Scheduled for elective shoulder and upper limb surgeries after obtaining written/informed consent from the patients.

Exclusion Criteria

- Patient's refusal
- Known allergy to local anaesthetic agents
- Traumatic nerve injury
- History of respiratory disorders
- History of neuromuscular diseases
- History of cardiovascular diseases
- Bleeding disorders or patient on anticoagulant therapy
- Hepatic or Renal failure
- Pregnant women

Each patient was randomly allocated to one of the two groups of 30 patients each.

Group B- Bupivacaine group receives 30ml bupivacaine 0.5% (5mg/ml)

Group L- Levobupivacaine group receives 30ml Isobaric levobupivacaine 0.5% (5mg/ml)

Results

Table 1: Comparison of Heart rate (bpm) distribution in two groups of patients studied

Heart rate (bpm)	Group B	Group L	P value
Intra-operative			
Basal	84.50±8.52	82.93±8.03	0.467
2min	83.13±9.35	80.67±8.86	0.299
4min	82.13±8.98	80.11±8.05	0.363
6min	81.70±8.73	80.13±8.63	0.487
8min	82.10±9.03	79.13±7.79	0.178
10min	81.83±8.78	80.23±7.60	0.453
15min	80.97±8.30	79.43±7.93	0.468
20min	80.53±8.83	79.80±7.69	0.733
25min	80.67±9.08	78.23±8.52	0.289
30min	80.63±8.86	80.00±7.99	0.772
60min	80.23±7.53	80.27±6.30	0.985
90min	80.10±8.18	79.60±7.86	0.810
120min	77.17±6.15	78.50±5.97	0.743

As shown in the table, there is no statistical difference in the heart rate variation between the two groups ($p > 0.05$).

Table 2: Comparison of SBP (mm Hg) distribution in two groups of patients studied

SBP (mm Hg)	Group B	Group L	P value
Intra-operative			
Basal	121.80±6.80	121.90±5.38	0.950
2min	118.97±7.59	119.77±6.40	0.660
4min	116.97±8.23	117.97±6.54	0.604
6min	112.27±20.51	115.83±6.44	0.367
8min	115.70±8.08	115.83±6.95	0.946
10min	114.63±7.31	115.80±6.89	0.527
15min	115.57±7.67	116.77±6.60	0.519
20min	115.43±7.32	115.50±6.40	0.970
25min	115.40±6.85	114.83±5.17	0.719
30min	116.13±6.66	116.07±5.38	0.966
60min	116.97±6.44	117.07±5.88	0.950
90min	117.17±6.16	116.97±5.51	0.895
120min	112.80±10.26	120.33±1.53	0.266

The systolic blood pressure measurement done at various time intervals did not show any statistically significant difference ($p > 0.05$) between the two groups.

Table 3: Comparison of DBP (mm Hg) distribution in two groups of patients studied

DBP (mm Hg)	Group B	Group L	P value
Intra-operative			
Basal	72.10±4.24	71.87±4.09	0.829
2min	71.10±4.29	71.13±3.82	0.975
4min	69.83±4.60	69.47±3.79	0.737
6min	68.80±5.31	69.40±3.89	0.619
8min	68.53±4.98	69.07±4.08	0.652
10min	68.43±5.93	69.13±5.02	0.624
15min	67.97±6.05	68.30±5.05	0.818
20min	68.03±5.80	68.13±4.52	0.941
25min	68.77±5.59	69.00±4.38	0.858
30min	68.30±4.82	68.50±3.52	0.855
60min	69.10±5.11	69.57±4.10	0.698
90min	68.23±4.67	68.73±4.19	0.664
120min	67.60±7.64	69.67±2.52	0.674

The diastolic blood pressure measurement done at various time intervals show no statistical difference between the two groups (p>0.05)

Table 4: Comparison of MAP (mm Hg) distribution in two groups of patients studied

MAP (mm Hg)	Group B	Group L	P value
Intra-operative			
Basal	88.97±4.35	88.83±3.62	0.898
2min	87.27±4.80	87.57±4.15	0.797
4min	85.80±5.44	86.00±4.30	0.875
6min	83.63±8.81	85.27±4.25	0.364
8min	84.60±5.63	85.03±4.68	0.747
10min	84.17±6.00	85.10±5.26	0.524
15min	84.13±6.19	84.77±5.01	0.665
20min	84.20±5.99	84.20±4.53	1.000
25min	84.63±5.69	84.70±4.31	0.959
30min	84.53±5.12	84.60±3.86	0.955
60min	85.50±4.99	85.63±3.90	0.909
90min	84.90±4.79	85.17±4.04	0.816
120min	83.00±7.52	87.00±3.46	0.429

The mean arterial pressure measurement done at various time intervals show no statistical difference between the two groups (p>0.05).

Table 5: Comparison of SpO2% distribution in two groups of patients studied

SpO2%	Group B	Group L	P value
Intra-operative			
Basal	99.70±0.47	99.70±0.47	1.000
2min	99.60±0.62	99.60±0.62	1.000
4min	99.67±0.61	99.67±0.61	1.000
6min	99.73±0.58	99.73±0.58	1.000
8min	99.73±0.78	99.73±0.78	1.000
10min	99.77±0.50	99.77±0.50	1.000
15min	99.83±0.38	99.83±0.38	1.000
20min	99.80±0.41	99.80±0.41	1.000
25min	99.77±0.63	99.77±0.63	1.000
30min	99.83±0.38	99.83±0.38	1.000
35min	99.80±0.48	99.80±0.48	1.000
40min	99.80±0.41	99.80±0.41	1.000
45min	99.83±0.38	99.83±0.38	1.000
50min	99.90±0.31	99.90±0.31	1.000
55min	99.83±0.38	99.83±0.38	1.000
60min	99.73±0.58	99.73±0.58	1.000
90min	99.77±0.43	99.77±0.43	1.000
120min	99.00±0.00	100.00±0.00	0.291

The saturation measurement done at various time intervals show no statistical difference between the two groups (p>0.05)

Discussion

We hypothesized that 0.5% isobaric Levobupivacaine administered for interscalene brachial plexus block in patients undergoing upper limb surgeries in would provide more stable haemodynamics and similar sensory and motor block characteristics as compared to Bupivacaine.

In our study demographic data comparing age, sex, weight showed no statistically significant differences between both the groups

There were no significant differences between the study groups with respect to changes in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure perioperatively.

A review by Stefanie *et al*. Supports the evidence that Levobupivacaine has clinical profile similar to that of racemic Bupivacaine. However, the reduced toxic potential of Levobupivacaine suggests its use in the clinical situations in which the risk of systemic toxicity related to either overdosing or unintended intravascular injection is high [7, 8].

Conclusion

In conclusion of our study, 0.5% isobaric Levobupivacaine has similar sensory and motor efficacy parameter compared to 0.5% Bupivacaine with haemodynamic stability when used for interscalene brachial plexus block for upper limb surgeries.

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