A comparative evaluation of hyperbaric ropivacaine versus hyperbaric bupivacaine in lower abdominal surgeries

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Abstract

Introduction: Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Use of regional anaesthesia which influence the early indicators of recovery such as time to consciousness, the incidence of postoperative nausea and vomiting (PONV), return of full cognitive function, these benefits may occur purely as a result of avoiding opioids, also with using regional anaesthesia, the quality of analgesia and time to first supplementary analgesic is significantly better than that with systemic opioids. Aims and Objective: To evaluate efficacy of hyperbaric ropivacaine versus hyperbaric bupivacaine in Lower abdominal surgeries. Material and Methods: In the presents study two groups were compared undergoing Lower abdominal surgeries. Group I received 3ml of 0.5% hyperbaric ropivacaine and group II received 3ml of 0.5% hyperbaric bupivacaine. Monitoring of vitals and observation for the block parameters were carried out and was compared between these two groups. Results: Ropivacaine has longer onset of action compared to bupivacaine. 9.6 ± 1 min in bupivacaine group while was 9.8 ±1.13 min in ropivacaine group. Ropivacaine has a shorter duration of action compared with bupivacaine it was 176 ± 13.8min for ropivacaine and 213±10.8min for bupivacaine. Ropivacaine had a significant lesser degree of motor blockade compared to bupivacaine. And also total duration of motor block was shorter for ropivacaine (126 ± 17.5) when compared with bupivacaine (195.2±37.7). Conclusion: Ropivacaine produces adequate spinal blockade of shorter duration with early ambulation and faster home discharge as compared with bupivacaine. Thus it can be used intrathecally with equal efficacy and better safety as bupivacaine in similar doses for short surgical procedures.

Keywords: hyperbaric ropivacaine, hyperbaric bupivacaine, efficacy.

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INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Acute postoperative pain management is not only a human feeling, but it is a key aspect of postoperative care, as acute pain, regardless of its site, can adversely affect nearly every organ function, and so affects the postoperative morbidity and mortality. Bupivacaine has been in clinical use for more than 30 years. It is widely used for spinal anaesthesia but it is associated with a number of side effects, including motor weakness, cardiovascular and central nervous system toxicity. This has resulted in the continuing search for new and safer local anesthetic agents. Ropivacaine (1-propyl 2'-6'-pipecoloxylidide hydrochloride monohydrate) is the s-enantiomer of a new amide local anesthetic which has been extensively evaluated in adults and older children. Recently, it has been used in adults and several studies have reported its clinical efficacy and safety when administered for spinal anesthesia. Ropivacaine has several properties which may be useful in practice, namely the potential to produce differential neural...
blockade with less motor block and reduced cardiovascular and neurological toxicity\(^3\). The potency of Ropivacaine in terms of sensory block has now been determined in clinical use; whether for infiltration anaesthesia, peripheral nerve branch, brachial plexus block, spinal block and lumber extradural block showed that ropivacaine was a long acting local anesthetic which gave surgical anaesthesia of good quality\(^5\). Thus the present study was designed to compare the clinical efficacy of hyperbaric solution of ropivacaine with commercially available preparation of hyperbaric bupivacaine in spinal anaesthesia in lower abdominal surgeries.

**AIMS AND OBJECTIVE**

To evaluate efficacy of hyperbaric ropivacaine versus hyperbaric bupivacaine in Lower abdominal surgeries.

**MATERIALS AND METHODS**

The present study was conducted at V.M.K.V.M.C Hospital. Before starting the study ethical approval was obtained from the Medical Ethics Committee of the Vinayaka missions University and the institutional review board of department of Anesthesiology. Consent of the patients was taken in addition to hospital committee approval.

Following inclusion and exclusion criteria was used to select the study subjects.

**Inclusion Criteria**

- Patients undergoing elective lower abdomen surgeries such as appendectomy hernioplasty, herniorrhaphy, ovariectomy, hysterectomy etc.
- ASA I and II

**Exclusion Criteria**

- ASA III or more.
- Patients with poor myocardial contractility, coagulopathy, back problems, spine deformity and local skin infections of site of injection
- Patients on potent antiplatelets, or on anticoagulants.
- Known allergy to the trial drugs.
- Patient refusal

By using above mentioned inclusion and exclusion criteria 50 patients were selected for the study. Informed written consent was taken from all patients before starting the study. The selected patients were divided into two groups containing 25 patients each.

**Study Groups**

- **Group I**: receive 3ml of 0.5% hyperbaric ropivacaine.
- **Group II**: receive 3ml of 0.5% hyperbaric bupivacaine.

Hyperbaric ropivacaine was prepared by adding 25% dextrose to 0.7% isobaric ropivacaine.

**RESULTS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group I (ropivacaine)</th>
<th>Group II (bupivacaine)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>40.32 ± 12</td>
<td>45.4 ± 12.7</td>
<td>0.446</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>54 ± 10.1</td>
<td>56.8 ± 8.2</td>
<td>0.519</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>166.8 ± 7.4</td>
<td>165.6 ± 8.1</td>
<td>0.440</td>
</tr>
<tr>
<td>ASA (I/II)</td>
<td>20/5</td>
<td>18/7</td>
<td>0.741</td>
</tr>
</tbody>
</table>

In the present study mean age of subject in group I was 40.32 years with SD 12 year, whereas mean age of subject in group II was 45.4 years with SD 12.7 year. Mean weight and height of the group I was 54kg and 166.8cm. And Mean weight and height of the group II was 56.8kg and 165.6cm. In group I 20 patients were of ASA I grade and 5 were of grade II. In group II 18 patients were of ASA grade I and 7 were of ASA grade II. Characteristics of patients’ age, weight, height, and ASA classification showed no statistically significant differences between these two groups (P > 0.05)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group I (ropivacaine)</th>
<th>Group II (bupivacaine)</th>
<th>T test</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset</td>
<td>9.8 ± 1.13</td>
<td>9.6 ± 1</td>
<td>0.662</td>
<td>0.531</td>
</tr>
<tr>
<td>Duration</td>
<td>176.4 ± 13.8</td>
<td>213.4 ± 10.8</td>
<td>10.55</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>Block height</td>
<td>T7 (T4–T11)</td>
<td>T6 (T5–T11)</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically Significant
It was observed mean duration for onset of sensory block (Pin-Prick at T10) was 9.8±1.13 min in group I (ropivacaine group) and 9.6 ± 1 min in group II (bupivacaine group). But the difference was not significant. The mean duration block in group II (213.4 ± 10.8) was more as compared to the group I (176.4 ± 13.8) and the difference was also statistically significant. Our study showed that the mean height of sensory block was T7 in ropivacaine group while it was T6 in bupivacaine group.

The total duration of motor block was significantly shorter with ropivacaine, it was 126±17.5 for ropivacaine and 195.2±37.7 for bupivacaine and this result was statistically significant. Onset of maximum degree of motor block was also studied and it was observed that it was 10.5±2.5 for ropivacaine and 8.75±2.0 for bupivacaine and the difference observed was also statistically significant. The Bromage scale degree of motor block was significantly greater with bupivacaine (P value<0.05). Out of 25 patients 24 developed grade three block (96%) and one patient developed grade two block, while with ropivacaine group 18 patient developed grade three block (72%),4 patients developed grade two block (16%) and 2 patients developed grade one block (8%) and one patient developed grade 0 block (4%).

It was observed that in ropivacaine group 8% patients complained about back ache, one complained headache. Whereas in bupivacaine group backache and headache was observed in 8% patients each. No patient had complaint of transient neurological symptoms.

**DISCUSSION**

The present study was conducted with the objective to evaluate hyperbaric ropivacaine versus hyperbaric bupivacaine in Lower abdominal surgeries. The mean age, weight and height of the patients in the two groups (ropivacaine and bupivacaine) was noted. And no statistical significant difference was observed in these two groups. Thus the two groups were comparable with respect to Age, Weight, Height and ASA grading. The mean duration for sensory block onset in ropivacaine group (9.8 ± 1.13) was more as compared to bupivacaine group (9.6 ± 1). But the difference was not statistically significant. We observed significantly lesser duration of sensory block in ropivacaine (176.4 ± 13.8) group as compared to bupivacaine group (213.4 ± 10.8). And the mean block height in both groups was nearly same. Thus we can say that ropivacaine produces slower onset than
bupivacaine. However the level of sensory block achieved was similar and the duration of sensory block was significantly lesser with ropivacaine. Similar finding were also reported by Whiteside et al. One of the reasons for this may be the lesser lipid solubility of ropivacaine. The lesser lipid solubility of ropivacaine may cause slow penetration of this drug in the large myelinated A fibers than the more lipid-soluble bupivacaine. But P. Gautier et al. and Andrea Casatiet al who compared the effect of intrathecal plain ropivacaine 5 mg/ml with bupivacaine 5 mg/ml for major orthopaedic surgery found no difference in the onset of block. It was observed that mean time to maximum degree of motor block was more in ropivacaine group (10.51±2.5 min) as compare to bupivacaine group (8.75±2.0) and the difference observed was also statistically significant. The total duration of motor block was much lower and statistically significant in ropivacaine group (126 ± 17.5) than bupivacaine group (195.2±37.7). Thus we observed that ropivacaine has a less potent effect on motor nerves and the degree of sensory-motor separation is more as compared with bupivacaine, but can produce reliable SA. Our observations have been supported by Brockway MS et al. and Morrison LM et al who also observed the similar findings in their studies. It was observed that in bupivacaine group out of 25 patients 24 developed grade three block (96%) and one patient developed grade two block. Whereas in ropivacaine group 18 patient developed grade three block (72%), 4 patients developed grade two block (16%) and 2 patients developed grade one block (8%) and one patient developed grade 0 block (4%) which may be attributed to faulty technique. Chan-Jun Chung et al reported that intrathecal ropivacaine produced excellent intraoperative analgesia and abdominal muscle relaxation, indistinguishable from spinal bupivacaine.

The proportion of patients reporting side effect was very less in ropivacaine as compared to bupivacaine group. The decreased cardiovascular and central nervous system toxicity makes Ropivacaine interesting alternative to racemic bupivacaine in procedures requiring large doses of local anaesthetic but this might not be true in spinal anaesthesia where the dosage of drug is comparatively small. Early studies had reported that isobaric ropivacaine have variable or inadequate block patterns in abdominal surgery. And it is now confirmed that the addition of glucose to the solution of ropivacaine has better effects as with other drugs used for SA. As hyperbaric ropivacaine is not available commercially, addition of glucose 3-10% to ropivacaine has been used and studied for surgeries under SA. In our study, the concentration of dextrose used is similar to that of commercially available hyperbaric bupivacaine. We used readily available 25% 10 ml dextrose ampoules, autoclaved to prevent the risk of bacterial contamination. It is known that ropivacaine is 30- 40% less potent and effects are short lived than bupivacaine making it advantageous for short to intermediate duration of surgeries or ambulatory surgeries.

CONCLUSION

Thus we could conclude that ropivacaine produces adequate spinal blockade of shorter duration with early ambulation and faster home discharge as compared with bupivacaine. Thus it can be used intrathecally with equal efficacy and better safety as bupivacaine in similar doses for short surgical procedures.

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