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Original Research Article

Comparison of the Effect of Epidural Levobupivacaine 0.5% 20 Ml and Ropivacaine 0.75%, 20 Ml in Lower Limb Surgeries

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Abstract:
Epidurally administered levobupivacaine 0.5% and ropivacaine 0.75% were compared for efficacy and safety in 97 lower limb surgery patients at Patna Medical College & Hospital over 14 months. The study assessed sensory and motor block onset, analgesia duration, hemodynamic stability, postoperative pain, patient satisfaction, and side effects. Levobupivacaine exhibited a faster motor block onset and longer analgesic duration than ropivacaine, increasing patient satisfaction. Both anesthetics had negligible adverse effects and steady hemodynamics. These data show that levobupivacaine may be better for procedures needing extended pain control, but patient and surgical variables should determine the anesthetic.
Keywords: Levobupivacaine, Ropivacaine, Epidural Anesthesia, Lower Limb Surgery.

Introduction

When it comes to ensuring the best possible anesthetic management during lower limb surgeries, the selection of local anesthetics for epidural administration plays a crucial role. This is because it directly affects the speed at which anesthesia takes effect, how long it lasts, and the overall quality of the anesthesia. [1] Additionally, it has a significant impact on patient safety and recovery outcomes. Levobupivacaine and ropivacaine, two types of local anesthetics, are commonly used because of their positive pharmacological characteristics, such as the lower risk of heart and nervous system toxicity when compared to bupivacaine. This introduction presents a summary of the effectiveness and safety of epidurally administered levobupivacaine 0.5% (20 ml) compared to ropivacaine 0.75% (20 ml) for lower limb surgical procedures. [2] Levobupivacaine is known for its decreased risk of causing harm to the heart and its ability to effectively block sensation and movement. Alternatively, ropivacaine, being a pure S-enantiomer, is recognised for its distinct blocking effect that prioritises inhibiting sensory nerves rather than motor block. This characteristic can be beneficial in promoting postoperative mobility and managing pain. When choosing between these two agents, it's important to carefully consider the delicate balance between providing sufficient anaesthesia and ensuring the preservation of motor function. This balance is crucial in promoting optimal patient recovery and overall satisfaction. [3]

When it comes to ensuring the best possible anaesthetic management for lower limb surgeries, the selection of local anaesthetics for epidural administration plays a crucial role. This is because the choice of anaesthetics can greatly affect the speed at which anaesthesia sets in, how long it lasts, and the overall quality of the anaesthesia. Additionally, it has a significant impact on patient safety and recovery outcomes. [4] Levobupivacaine and ropivacaine, two types of local anaesthetics, are commonly used because of their positive pharmacological characteristics. [5] These include a lower risk of cardiotoxicity and central nervous system toxicity when compared to bupivacaine. This introduction offers a comprehensive look at the effectiveness and safety of epidurally administered levobupivacaine 0.5% (20 ml) versus ropivacaine 0.75% (20 ml) for lower limb surgical procedures. [6]

Recent studies have investigated different aspects of these anaesthetics, such as how quickly they take effect, how long they provide pain relief, their impact on heart rate and blood pressure, their ability to manage pain after surgery, and any potential side effects. [7] These studies offer valuable insights into enhancing the selection of anesthesia based on individual patient characteristics and surgical needs. This analysis seeks to explore these aspects by comparing the effectiveness and safety profiles of levobupivacaine 0.5% and ropivacaine 0.75% in lower limb surgeries. Both solutions will be administered at a volume of 20 ml. [8]

Methodology

This prospective, randomized controlled trial compared the efficacy and safety of epidurally given levobupivacaine 0.5% and ropivacaine 0.75% in lower limb surgery patients. The 14-month study was conducted at Patna Medical College & Hospital, a tertiary care center with a strong surgery and anesthesiology department.

Study Participants

The study included 97 participants randomly assigned to two groups using a computer-generated sequence:
Group L received 20 ml of 0.5% levobupivacaine. Group R received 20 ml of 0.75% ropivacaine. Adults 18–65 with ASA physical category I–III who were undergoing elective lower limb procedures were eligible. The study excluded patients with epidural contraindications, local anesthetic allergies, coagulation abnormalities, or neurological impairments.

Study Procedures: Pre-epidural vital signs—heart rate, blood pressure, and oxygen saturation—were taken. The research medication was delivered after identifying the epidural space at an acceptable spinal interspace utilizing loss of resistance. The Bromage scale and pinprick method were used to measure sensory and motor block onset.

Outcome Measures: Primary outcome measures: - Sensory and motor block onset time.

Analgesia Duration

- Heart rate and blood pressure at 5, 10, 15, 30, 45, 60-, 90-, and 120 minutes post-administration. - VAS pain and satisfaction levels at 1, 6, 12, and 24 hours postoperatively.

Effects like hypotension, bradycardia, nausea, vomiting, and pruritus were recorded as secondary outcomes.

Data Collection and Statistical Analysis

Regular forms were used to enter data into a secure database. Statistical analysis was done with SPSS. The student's t-test or Mann-Whitney U test was used to analyse continuous variables, depending on data distribution. Chi-square or Fisher's exact tests compared categorical data. A p-value under 0.05 was significant.

Results

The study effectively recruited 97 patients, with 48 patients assigned to Group L and 49 patients assigned to Group R. The demographic and baseline characteristics were similar between the two groups, showing no notable variations in age, gender, ASA physical status, or type of surgery. In Group R, the sensory block started a bit quicker with a mean time of 12.8 minutes to achieve a complete sensory block, compared to 14.5 minutes in Group L. However, it's worth noting that this difference did not reach statistical significance ($p=0.07$). Group L exhibited a notably quicker onset of motor block, with an average time of 18.2 minutes, in contrast to Group R's 21.4 minutes ($p=0.03$). Group L had a longer duration of analgesia, with an average duration of 289 minutes, compared to 254 minutes in Group R. The observed difference reached statistical significance with a p-value of 0.04. Both groups consistently maintained stable hemodynamic parameters throughout the study.

A few patients in Group L and Group R experienced minor episodes of hypotension and bradycardia, but these incidents were successfully addressed using standard interventions. There were no notable variations observed between the groups in terms of hemodynamic stability ($p=0.32$). The pain scores after surgery, as assessed by the Visual Analogue Scale (VAS), showed a significant decrease in Group L at 1 hour ($p=0.02$) and 6 hours ($p=0.03$) after the procedure. At 12 and 24 hours, the pain scores showed no significant difference between the groups. Group L had a significantly higher patient satisfaction rate, with 89% of patients reporting being 'very satisfied' compared to 76% in Group R ($p=0.05$). The occurrence of negative effects was minimal and comparable among the groups. Four patients in Group L and five in Group R experienced nausea. It was noted that three patients in each group experienced pruritus. Both groups did not experience any significant adverse events or neurologic complications.

Table 1: This table summarizes the main outcomes and statistical significance observed in the study, which can be helpful for quick comparison and assessment of the two anesthetics used during lower limb surgeries.

Parameter	Group L (Levobupivacaine 0.5%)	Group R (Ropivacaine 0.75%)	P-value
Number of Patients	48	49	N/A
Onset of Sensory Block (minutes)	14.5	12.8	0.07
Onset of Motor Block (minutes)	18.2	21.4	0.03
Duration of Analgesia (minutes)	289	254	0.04
VAS Score at 1 Hour	2 (low pain)	3 (moderate pain)	0.02
VAS Score at 6 Hours	3 (moderate pain)	4 (moderate pain)	0.03
Patient Satisfaction (% very satisfied)	89%	76%	0.05
Adverse Effects: Nausea	4	5	N/A
Adverse Effects: Pruritus	3	3	N/A

Discussion

A comparative study was conducted on the administration of levobupivacaine 0.5% and ropivacaine 0.75% in lower limb surgeries. The study yielded important findings that have important implications for clinical practice in the field of regional anesthesia. This discussion delves into the implications of these findings, draws comparisons with existing literature, and proposes potential avenues for future research. [9]

Studies have shown that ropivacaine has a slightly faster onset time for sensory block compared to levobupivacaine. This may be due to ropivacaine's lower lipid solubility, which allows it to permeate through nerve sheaths more rapidly. [10]

Nevertheless, the observed distinction did not reach statistical significance, possibly attributed to the greater concentration of ropivacaine employed (0.75% compared to 0.5% for levobupivacaine). On the other hand, levobupivacaine exhibited a notably quicker initiation of motor block. [11] One possible explanation for this is its increased strength and ability to dissolve in fats, allowing it to enter motor nerve fibers more rapidly. Levobupivacaine offers an extended period of pain relief, which is crucial for effectively managing postoperative discomfort. This prolonged pain relief could decrease the necessity for extra pain medications after surgery, thus improving the comfort and satisfaction of patients. This observation aligns with previous research that has highlighted the prolonged duration of levobupivacaine's effects. [12] This is attributed to its strong binding capacity and gradual release from nerve receptors. [13]

The hemodynamic parameters remained stable throughout the study for both levobupivacaine and ropivacaine. [14]

This is in line with their well-established reputation for having lower cardiotoxicity compared to bupivacaine. The occurrences of low blood pressure and slow heart rate were successfully controlled and showed no significant differences between the groups, indicating the safety of both anesthetics for epidural administration in lower limb surgeries. The enhanced pain management experienced by patients at 1- and 6 hours after surgery using levobupivacaine may have played a role in the increased level of satisfaction reported in this particular group. Ensuring optimal pain management in the early stages after surgery is essential for promoting patient recovery, minimizing hospitalization duration, and enhancing overall treatment results. [15]

The improved pain management seen with levobupivacaine may be attributed to its strong pain-relieving properties and extended period of effectiveness.

The occurrence of nausea and itching was minimal and similar in both groups, highlighting the satisfactory safety record of both medications. This study's findings indicate that the use of these anesthetics in clinical settings can be continued, as no significant adverse effects were observed. However, it is important to exercise caution and closely monitor patients during their administration.

This study provides evidence supporting the effectiveness and safety of levobupivacaine and ropivacaine in the use of epidural anesthesia for lower limb surgeries. The extended duration of pain relief offered by Levobupivacaine and its ability to enhance patient satisfaction make it a valuable choice for surgeries that necessitate long-term pain management.

Nevertheless, it is crucial to customize the selection of anesthetic based on the unique attributes of each patient and the particular circumstances of the surgery.

Further research could investigate the economic viability of these anesthetics, patient results in various lower limb procedures, and the extended recovery patterns after surgery. In addition, it would be beneficial to conduct additional research

to explore the impact of various concentrations and volumes of these anesthetics. This would help in refining the dosing regimens for specific groups of patients.

Conclusion

This study showed that levobupivacaine 0.5% and ropivacaine 0.75% are safe and effective epidural anesthetics for lower limb procedures, with both having advantages. The earlier onset of motor block and longer duration of analgesia with levobupivacaine led to higher patient satisfaction than ropivacaine. Both anesthetics maintained steady hemodynamic parameters and had minor adverse effects, however, levobupivacaine's longer pain control implies it may be better for protracted analgesia treatments. These data help anesthesiologists choose the right anesthetic for surgical patients' demands and outcomes.

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