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A STUDY ON THE COMPARATIVE EFFECTS OF EPIDURAL BUPIVACAINE AND EPIDURAL ROPIVACAINE IN COMBINED SPINAL AND EPIDURAL ANESTHESIA FOR JOINT REPLACEMENT AND LOWER LIMB SURGERIES

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ABSTRACT

Background: Epidural Bupivacaine and Epidural Ropivacaine are considered as rescue drugs for postoperative Analgesia in patients undergoing unilateral joint replacement and lower limb surgeries. This work aims to find the use of epidural Ropivacaine and Bupivacaine for joint replacement and lower limb surgeries. **Methods:** This ranadomzed controlled trial was carried out on 50 surgical patients of age 40-60 years and weight of 40-70 kg for unilateral joint replacement and lower limb surgeries. Patients were divided into two groups - Epidural Ropivacaine was given in one of the groups and Epidural Bupivacaine was given to patients of other group. **Results:** Demographic variables including age, weight, gender distribution, ASA Grade were comparable between the Epidural Ropivacaine and Epidural Bupivacaine groups in a comparative study between Epidural Ropivacaine and Epidural Bupivacaine, Epidural Bupivacaine demonstrated the increased period of analgesia compared to Ropivacaine, Bupivacaine was effective up to 7 hours after administration and thus cost effective for surgeries that are anticipated to cause prolonged pain. **Conclusion:** Bupivacaine can be used successfully in patients undergoing unilateral joint replacement and lower limb surgeries as it provides Analgesia for long time as compared to Bupivacaine in unilateral joint replacement and lower limb surgeries.

KEYWORDS: Combined spinal Epidural Anesthesia, Epidural Ropivacaine, Epidural Bupivacaine, Unilateral joint replacement surgeries, Rescue analgesia.

INTRODUCTION

Postoperative pain is one of the most common issue following joint replacement surgeries although number of advancements in techniques and pain control modalities has taken place yet majority of patients experience extreme pain immediately after surgery, poorly controlled pain after surgeries is strongly associated with chronic pain.

Combined spinal epidural anesthesia is an important component of multimodal aproach to pain management used effectively for post-operative pain management in patients undergoing unilateral joint replacement surgeries and lower limb surgeries. The most important concept of current pain management is pre-emptive refers to the initiation of pain management before the surgical stimulus. However in recent years, a long acting local anesthetic drugs such as Ropivacaine and the Bupivacaine are used epidurally for post-operative analgesia in patients undergoing unilateral joint replacement and lower limb surgeries. The aim of the study was to study comparative effects of the efficacy of epidural ropivacaine and Bupivacaine in combined spinal and epidural anesthesia for joint replacement and lower limb surgeries. The objectives of the study were to diffrentiate the hemodynamic stability among both the groups received Epidural injection of ropivacaine and Bupivacaine, to examine duration of analgesia in both of the groups, and to compare the incidence of side effects in both of the groups.

MATERIALS AND METHODS

The present study was carried out at Government Medical College and Hospital, Chandigarh, Punjab, between January to June, 2024, after obtaining the approval from the ethical comitee of the hospital.

A total of 50 surgical patients of age 40-60 years of body weight 40-70 kg with ASA grade-l and ll were scheduled for elective unilateral joint replacement and lower limb surgeries. A written informed consent was taken from all the patients. All the patients were randomly divided in to two groups of 25 each. Group-A - patients in this group received Epidural injection of Ropivacaine. Group-B - patients in this group received Epidural injection of Bupivacaine.

The patients were considered with the inclusion criteria as followed

- Patients Electively scheduled for unilateral joint replacement and lower limb surgeries.
- Patients with age 40-60 years.
- ASA Grade l and ll
- Patients with ability to provide informed consent.

The subjects were excluded with the following exclusion criteria

- History of allergy to any drug.
- Any deformity in spinal cord.
- ASA grade lll and lV.
- Patients in Anticoagulant therepy.
- Patients with severly compromised co- Morbidities.

Pre-Anesthetic-Checkup

A comprehensive pre-Anesthetic -checkup with patients detailed clinical investigations like CBC, HB, bleeding time, clotting time, were obtained before the surgery.

Anesthetic Technique

In the operation theatre standard non invasive blood pressure monitor, pulse Oximeter, and electrocardiogram leads were attached to the patients and baseline heart-rate and blood pressure was recorded. Appropriate intravenous Acess was established and Preloading with 10-15ml/kg of ringer lactate was done 15-30 minutes prior to the injection of local Anesthetic.

Patients were placed in right or left lateral position and under all aseptic conditions combined spinal epidural using portex minipak with lock pencil point spinal needle 26 guage was given through needle technique at L3, L4, using midline approach 1.5ml of study solution was injected intrathecally over a period of 10-seconds. After verifying the free flow of Cere-brospinal fluid the spinal needle was removed and an Epidural catheter was inserted 5cm in to the epidural space and secured with adhesive tap. epidural catheter was flushed with 2ml of saline but no medication was injected via the catheter motor blockade was assesed at the time of reaching peak sensory level and was considered the maximum motor blockade. All the patients were placed in appropriate positions and inj Midazolam 1 mg intravenously was given to all the patients. Oxygen 3 litres/minute was given continuously via face mask.

The Following Parameters Were Recorded

Every 2 minutes from the time of intrathecal injection sensory level was checked until the level stablised for 4 consecutive tests peak sensory level was noted after that the peak sensory level was continued every 10 minutes until two segment regression.

Motor block was assessed by Bromage scale.

SCORE

0 = No motor blockade.
1 = Hip Blocked.
2 = Hip and Knee Blocked
3 = Hip knee and foot blocked was recorded.

Intraoperative complications like hypotension was taken as 30% decrease in systolic blood pressure compared with pre-operative control levels or blood pressure less then 90 mmHg and bradycardia was taken as less then 60B/pm or 20% decrease from the baseline which ever is less. Adverse effects such as nausea and vomiting, hypotension, bradycardia, Pruritis, urine retention, and shivering was also noted at the end of surgery. Peak Sensory level was checked again along with Bromage score for motor block. Epidural infusion was started according to the group selection. Start time of epidural infusion was also noted.

RESULTS

Ropivacaine, however has a relatively shorter time of onset which is between 10 to 20 minutes. It is also effective in its use and it has a duration of action of 4-6 hours just like bupivacaine the characteristic make it ideal for procedures where intense post-operative pain is not expected. Bupivacaine is one of the most commonly utilized local Anesthetic agent because of it’s high potency and moderately long lasting Anti-inflimatory effects it is generally slower in the rate of induction compared to other Anesthetics may take between 15-39 minutes, depending on the concentration of the subestance and the volume used. However when applied correctly Bupivacaine has a longer duration of action in producing Analgesia that may last up to 7 hours and can be used in lengthy operations and for post-operative pain control.

The distribution of age of the participants shows that the second age bracket has the highest number of participants accounting for (56.0%) . largest is the group of people whose age can be estimated to range between 4 to 6.0 this shows the joint replacement surgeries are common in this group.

The gender distribution shows (62.0%) men, which may after analgesic efficacy and side effect study due time the gender differences in physiology. The youngest

individuals (6.0%) were less likely to need these operations. Demographic data with many age groups and gender ratios permits careful analysis of their influence on surgical pain management Effectiveness and Anesthetic side effects this examination helps determine how Bupivacaine and Ropivacaine effect patients.

Table 1: Onset of action and duration of analgesia.

Anesthetic	Onset of action	Duration of Analgesia
Bupivacaine	15-30 minutes	up to 7-hours
Ropivacaine	10-20 minutes	4 to 6 hours

Table 2: Age-group-wise distribution of the patients.

Valid	Frequency	Valid percent
1	3	6.0
ss 2	28	56.0
3	2	4.0
4	10	20 0
5	7	14.0
Total	50	100

Tabe 3: Gender-wise distribution of the patients .

Valid	Frequency	Percent	Valid percent	Cumulative percent
1	31	62.0	62.0	62.0
2	13	26.0	26.0	88.0
3	6	12.0	12.0	100.0
Total	50	100	100.0	

DISCUSSION

The findings from the study provided valuable insights in to the benefits and risks of Bupivacaine and Ropivacaine for the treatment of post-operative pain after joint replacement and lower limb surgeries. Some of the results Aligned with the literature while others produced relatively new observations that could have implications for clinical practice in the future (Sane et al, 2021).

This study also supported the use of Bupivacaine for long lasting analgesic activity as is evidenced by this study where pain relief lasted up to 7 hours after administration. This duration is especially important when it comes to more complex nad major surgeries when long term pain relief is the paramount for the patient. The capacity of Bupivacaine in maintaining post-operative analgesic significantly dimnishes the demand for opoids in the early hours after the surgery which is of great importance in the current evidence -based practices focusing on sparing opoids because of their risk and complications (Erilmaz et al., 2022) pharmacokinetics of Bupivacaine play a important role in its long lasting analgesic it is very lipophilic and this enables it to diffuse across nerve membrane barriers well and remain at the nerve site, hence increasing its action the characteristics of Bupivacaine makes it suitable for use in surgeries that require pain relief after operations.

But Bupivacaine is comparatively slower in its action and takes about 15-30 minutes to reach its peak effect, which can be drawback in some clinical conditions, where the patient requires relief of pain immediately, in patients requiring urgent surgery or procedures where the radpid onset of of analgesia is critical this delay will effect the general time taken to initate surgical procedures as well as possible prolonged discomfort for the patient (Wang et al, 2020) in addition since the duration of action of Bupivacaine and id risk of local anesthetic Syestmic toxicity when dosed improperly, this is because Bupivacaine is more potent and binds extensively to tissues. Acting with in 10-20 minutes after administration Ropivacaine has also an advantage in surgeries where it is necessary to achieve a rapid onset of pain relief. This characteristic is especially beneficial in ambulatory or outpatient surgeries, operations for which entail patients to recover and be discharged on the same day. The early onset and increased efficiency for effective pain management does not only reduce patient suffering but also promotes early mobilization and rehabilitation, which is crucial to the best recovery process (Olausson et al., 2022).

Ropivacaine is structurally related to Bupivacaine and is only slightly less, lipid solouble, because of small differences in its structure. This change dimnishes its capacity to penetrate through nerve sheaths, which contribute to a low likelihood of motor blockade inherent to the agent (Lewis et al., 2021). This aspect is paramount in operations where the patients need to use their limbs after surgery such as knee or hip replacement where mobilization can a long way in recovery process.

CONCLUSION

Bupivacaine provides the increased period of analgesia compared to Ropivacaine. Bupivacaine was effective upto 7 hours after administration and thus cost effective for surgeries that are anticipated to prolonged pain. The characteristic supports the claim that Bupivacaine Is

effective in managing pain after surgeries that require longer duration of pain relief on the other hand Ropivacaine was noted to have a more rapid onset of action with in 10-20 minutes. The quicker action makes Ropivacaine suitable for use where fast onset of pain relief is needed shortly after surgery effective and time pain control is vital in increasing patients satisfaction and to allow quicker discharge mechanisms such as in Ambulatory surgeries.

DECLARATION BY AUTHORS

The authors hereby declared that it was their original piece of research and had not been sent to any other journal for publication.

ETHICAL APPROVAL

Approved.

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