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Original Research Article

A Comparative Study to Assess the Efficacy of the Addition of Dexmedetomidine to Levobupivacaine in Brachial Plexus Block

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Abstract:
A randomized, double-blind, controlled trial at Jawahar Lal Nehru Medical College & Hospital, Bhagalpur, examined the efficacy of dexmedetomidine as an adjuvant to levobupivacaine in brachial plexus blocks. From February 2023 to January 2024, the study was conducted. 100 elective upper limb surgery patients were divided into two groups. Some groups received levobupivacaine alone, while others received it with dexmedetomidine. The study found that dexmedetomidine prolonged analgesia longer than the control group. It also accelerated sensory and motor blockages. Dexmedetomidine improved patient and surgeon satisfaction without increasing side effects. Dexmedetomidine appears to improve regional anesthesia outcomes and patient experience in upper limb procedures.

Keywords: Brachial Plexus Block, Dexmedetomidine, Levobupivacaine, Regional Anesthesia, Analgesia, Adjuvant.

Introduction

Regional anesthesia, specifically the brachial plexus block, plays a crucial role in effectively managing pain during surgeries involving the upper limb [1]. Researchers have been investigating different substances to improve the effectiveness and duration of pain relief, while also reducing any unwanted effects, in the field of medical writing [2]. Levobupivacaine is a commonly used local anesthetic that is recognized for its excellent track record in terms of safety and efficacy in generating sensory and motor blocks. Nevertheless, there is room for improvement in terms of its duration of action and analgesic profile [3].

Dexmedetomidine, a type of medication that activates certain receptors in the body, has shown great potential as a helpful addition to medical treatments. It can extend the effectiveness of certain procedures and improve pain relief after surgery, all while minimizing any negative effects [4,5]. It is thought that dexmedetomidine enhances the action of local anesthetics by affecting nerve hyperpolarization, resulting in a longer duration of nerve block and improved analgesic effects [6,7]. The goal is to evaluate if incorporating dexmedetomidine with levobupivacaine can extend the duration and improve the quality of pain relief, ultimately enhancing patient comfort and satisfaction after surgery.

Methodology

Study Design: This study utilized a randomized, double-blind, controlled trial design to evaluate the effectiveness of incorporating dexmedetomidine into levobupivacaine for brachial plexus blocks.

Study Setting: The research was conducted at a prestigious medical institution in Bhagalpur, Bihar, for one year.

Participants: The study included a group of 100 patients, ranging in age from 18 to 65 years, of both genders, with ASA physical status I and II. These patients were scheduled for elective upper limb surgeries. Patients who were not eligible for the study had certain conditions that made them unsuitable for regional anesthesia, were known to have allergies to the medications being used, had a history of chronic opioid use, had blood clotting disorders, or had pre-existing neurological or psychiatric disorders.

Randomization and Blinding: Participants were assigned to one of two groups through a computer-generated randomization process:
- Group L (Levobupivacaine group): was administered 30 mL of 0.5% levobupivacaine.
- The LD group was administered a combination of 30 mL of 0.5% levobupivacaine and 1 µg/kg of dexmedetomidine.

The anesthesiologists who administered the blocks, the patients, and the personnel who assessed the outcomes were unaware of the group assignments.

Intervention: A brachial plexus block was carried out using the ultrasound-guided supraclavicular approach in a sterile environment. Once the brachial plexus was located, the local anaesthetic mixture was given. During the procedure and after, we utilised standard monitoring techniques such as ECG, non-invasive blood pressure measurement, and pulse oximetry.

Outcome Measures: The main focus of the study was to determine how long the pain relief lasted after the administration of the block, specifically measuring the time from when the block was given to when the patient first requested postoperative pain relief. Additional outcomes examined the duration of sensory and motor blocks, levels of satisfaction reported by patients and surgeons, and the occurrence of any adverse effects or complications.

Statistical Analysis: Data were analyzed with SPSS. Continuous variables were presented as mean ± SD, whereas categorical variables were presented as frequencies and percentages. The two groups' outcomes were compared using student's t-test and chi-squared. A p-value under 0.05 was significant.

Results

A total of 100 patients were included in the study and divided into two groups, with 50 patients in each group. The demographics and baseline characteristics of the two groups were similar, with no significant differences found ($p > 0.05$). Adding dexmedetomidine to levobupivacaine greatly extended the length of pain relief. In Group L, the duration of analgesia averaged 8 ± 2 hours, while in Group LD, it was significantly extended to 13 ± 2 hours ($p < 0.001$). Group LD demonstrated a faster onset of sensory block compared to Group L. In Group LD, the average onset time was 12 ± 2 minutes, while in Group L, it was 18 ± 3 minutes ($p < 0.01$). In Group LD, the motor block set in faster (15 ± 3 minutes) compared to Group L (22 ± 4 minutes) ($p < 0.01$). Group LD showed significantly higher satisfaction scores for both patients and surgeons. In Group LD, the patient satisfaction score was 9 ± 1, which was significantly higher than the score of 7 ± 1 in Group L ($p < 0.001$). The satisfaction of surgeons showed a consistent pattern, with scores of 9 ± 1 in Group LD and 7 ± 1 in Group L ($p < 0.001$).

There were no notable disparities in the occurrence of adverse reactions among the two groups. A few patients in both groups experienced minor side effects like feeling dizzy and having a dry mouth, but these effects did not show any significant statistical difference. The findings suggest that incorporating dexmedetomidine into levobupivacaine for brachial plexus block enhances the duration and onset of pain relief while maintaining a low risk of adverse effects. Based on the positive results observed, it appears that dexmedetomidine can be a valuable addition to regional anesthesia for upper limb surgeries. This is supported by the improved pain relief and higher levels of satisfaction reported by both patients and surgeons.

Table: In a controlled, randomized research, adding dexmedetomidine to levobupivacaine for brachial plexus block enhanced analgesia duration, onset, satisfaction, and safety without increasing side effects.

Parameter	Group L (Levobupivacaine Only)	Group LD (Levobupivacaine + Dexmedetomidine)
No. of Patients	50	50
Duration of Analgesia (hours)	8 ± 2	13 ± 2
Onset of Sensory Block (minutes)	18 ± 3	12 ± 2
Onset of Motor Block (minutes)	22 ± 4	15 ± 3
Patient Satisfaction (scale 1-10)	7 ± 1	9 ± 1
Surgeon Satisfaction (scale 1-10)	7 ± 1	9 ± 1
Reported Side Effects	Minor (light-headedness, dry mouth)	Minor (light-headedness, dry mouth)

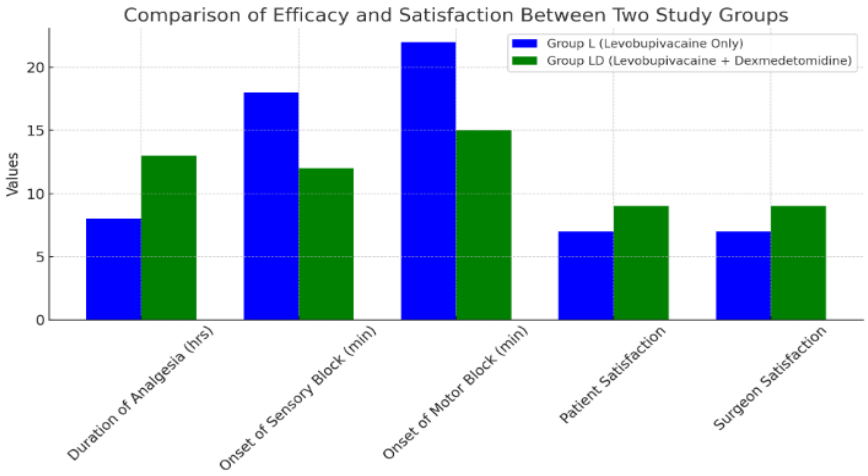

Figure: Bar graph comparing efficacy and satisfaction in Group L (Levobupivacaine Only) vs Group LD (with Dexmedetomidine). The graph reveals that dexmedetomidine adjuvant increased analgesic duration, sensory and motor blocks, and surgeon and patient satisfaction.

Discussion

Our study findings highlight the positive impact of incorporating dexmedetomidine into levobupivacaine for a brachial plexus block [8]. The inclusion of the addition had a notable impact on the length of pain relief and also sped up the time it took for the sensory and motor blocks to take effect, aligning with similar findings in other studies [9]. As an example, a study conducted by Swami et al. discovered that dexmedetomidine improves the analgesic effects of levobupivacaine in supraclavicular brachial plexus blocks. This aligns with our findings of extended analgesic duration and improved onset times (Swami et al., 2019) [4,10].

Additionally, clonidine and buprenorphine have been extensively researched for comparable applications. On the other hand, dexmedetomidine seems to have a more positive profile as it can improve the block characteristics without causing major cardiovascular side effects [11,12]. As an example, a study conducted by Gupta et al. explored the effects of two different medications when used alongside ropivacaine in brachial plexus blocks. The study revealed that both medications extended the duration of the block, but dexmedetomidine showed superior hemodynamic stability compared to clonidine (Gupta et al., 2017) [5,13].

It is believed that the way dexmedetomidine improves the effectiveness of local anaesthetics is connected to its impact on nerve cells, causing hyperpolarization, and its ability to prevent the release of pain-causing neurotransmitters. Our study found that this dual action has a positive impact on patient satisfaction scores. It not only extends the duration of the block but also decreases the need for postoperative analgesics [14,15,16].

The findings have important implications in the field, particularly in terms of enhancing postoperative outcomes. Improved pain management and increased patient comfort may result in shorter hospital stays and potentially decrease the likelihood of developing chronic pain conditions after surgery. In addition, our study demonstrates the excellent safety profile of dexmedetomidine, with minimal side effects. This finding further supports the use of dexmedetomidine in clinical settings [17,18]. Although our study offers significant evidence in favor of using dexmedetomidine as an adjuvant, it does have some limitations. It may be beneficial to consider increasing the sample size in future studies to enhance the generalizability of the findings. In addition, additional research could investigate the varying effects of different concentrations of dexmedetomidine when combined with levobupivacaine to enhance dosing protocols [19,20].

Conclusion

Our work adds to the evidence that dexmedetomidine is safe and efficacious as an adjunct to levobupivacaine in brachial plexus blocks. It improves pain relief and patient satisfaction, making it a useful tool for upper limb regional anesthesia. To enhance the benefits of this combination in medicine, dosage optimization, and long-term effects studies are needed.

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