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Original Research Article

Comparison of the Efficacy of Clonidine with Levobupivacaine versus Levobupivacaine Alone in Supraclavicular Brachial Plexus Block for Upper Limb Surgery

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Abstract

Background: The supraclavicular brachial plexus block is a safe, effective, and cost-efficient method of anesthesia. To extend its effects into the postoperative period and provide analgesia, adjuvants such as clonidine, dexamethasone, and adrenaline are often added. This study was conducted to compare the efficacy and safety of clonidine combined with levobupivacaine for supraclavicular brachial plexus blockade.

Methods: A randomized single-blind controlled trial was conducted with 40 patients of ASA Grade I or II undergoing upper limb surgery. Group A (n = 20) received 30 ml of 0.5% levobupivacaine and 1 ml of normal saline through the supraclavicular approach for the brachial plexus block, while Group B (n = 20) received 30 ml of 0.5% levobupivacaine with 0.3 ml clonidine (50 µg), diluted with normal saline to make up the solution to 1 ml. Vital parameters were recorded 10 minutes before block placement and every 3 minutes afterward until the end of the procedure. The onset and duration of both sensory and motor blocks, as well as sedation scores, were recorded. All patients were monitored in the post-anesthesia care unit and received a tramadol injection of 100 mg IV in 100 ml of saline as soon as they reported pain as a rescue analgesic. The duration of analgesia was measured from the time of block placement until the administration of the rescue analgesic.

Results: In Group B, the onset of motor and sensory blockades was faster. No statistically significant difference was observed in heart rate, blood pressure, and oxygen saturation between the groups. Sedation scores were higher in Group B, and postoperative analgesia lasted for 946.17 ± 137.99 minutes compared to 655 ± 159.39 minutes in Group A, which was statistically very significant ($p < 0.0001$).

Conclusion: Our study concluded that levobupivacaine is an effective drug for supraclavicular brachial plexus block, providing a long duration of pain relief with minimal disturbances in hemodynamic variables. Adding 50 µg of clonidine as an adjuvant to levobupivacaine prolongs the duration of sensory and motor blocks while reducing the latency period.

Keywords: Clonidine, Levobupivacaine, Supraclavicular Brachial Plexus Block.

Introduction

A peripheral nerve block (PNB) involves injecting a local anesthetic around a nerve or group of nerves to block nerve impulse conduction, resulting in temporary analgesia and loss of sensory and motor function [1]. Peripheral nerve blockade is now a well-established component of comprehensive anesthetic care. Peripheral nerve blocks are cost-effective anesthetic techniques that provide excellent anesthesia and analgesia while avoiding airway instrumentation, compared to the hemodynamic consequences of general and neuraxial anesthesia [2]. As a result, interest in regional anesthesia is rapidly growing worldwide. Patient satisfaction and increasing demand for a favorable postoperative recovery profile have led to a rising demand for regional anesthesia. Satisfactory surgical conditions are achieved with complete sensory and motor blockade. Concurrent sympathetic blockade reduces postoperative pain, vasospasm, and edema. Currently, bupivacaine is the most frequently used local anesthetic due to its long duration [3]. The use of α_2 adrenoceptor agonists to enhance peripheral nerve blocks has added a new dimension to their clinical application [4]. Clonidine's ability to reduce the dosage requirements of traditional anesthetic and analgesic agents is increasingly utilized in the perioperative period. When combined with a local anesthetic, clonidine has been found to extend the duration of

nerve block [5]. It is postulated that this action could be due to local vasoconstriction or facilitation of C-fiber blockade [6]. The present study aims to evaluate the postoperative analgesic effects and efficacy of clonidine (an α-2 agonist) in combination with levobupivacaine on peripheral nerves during a supraclavicular brachial plexus block.

Materials and Methods

The cross-sectional study was conducted in the Department of Anesthesiology, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was obtained for the study after duly following the protocol for human research based on the Helsinki Declaration. This study involved 40 patients with American Society of Anesthesiologists (ASA) I and II status of either sex, undergoing upper limb surgery under a supraclavicular brachial plexus block. All patients underwent a thorough pre-anesthetic evaluation.

Inclusion Criteria

1. Upper limb surgeries
2. Males and Females
3. ASA I and II status
4. Aged 18 to 60 years
5. Willing to participate in the study voluntarily.

Exclusion Criteria

1. Patients on beta blockers
2. Patients on opioids,
3. Patients receiving anticoagulants
4. Patients on chronic analgesics
5. History of significant systemic diseases
6. Hypersensitivity to Local anesthetics

The aim was to evaluate the clinical effects of clonidine as an adjuvant to a supraclavicular brachial plexus block with 0.5% levobupivacaine. Permission from the institutional ethical committee was obtained before starting the study and informed written consent was obtained from all patients. After carefully explaining the procedure to the patients, they were randomly divided into two groups using a table of random numbers. Group A (n = 20) received 30 ml of 0.5% levobupivacaine with 1 ml of normal saline. Group B (n = 20) received 30 ml of 0.5% levobupivacaine with 0.3 ml clonidine (50 μg), diluted with normal saline to make up the solution to 1 ml. Drugs were prepared by an anesthetist who was not involved in the study's proceedings.

After the transfer of the patient into the operating room, peripheral intravenous access was obtained, and Ringer's lactate infusion was initiated, in addition to a bolus intravenous dose of 4mg ondansetron. The patient was placed lying flat on the operating table, and standard ECG leads were connected. Initial vital signs including pulse rate, blood pressure, SpO_2, ECG, and respiratory rate were obtained. The head was rotated 30 degrees away from the procedure side to localize the interscalene groove on palpation. The usefulness of the peripheral nerve stimulator was established. The skin electrode was positioned on the ipsilateral arm at a distance of 6 inches and the red alligator clip was connected as anode. Aseptically, the supraclavicular area was cleaned with Savlon, spirit, and betadine, and the area was adequately isolated. The arm on the same side was moved towards the midline of the body. The interscalene groove was then located and, with pressure applied at the lowest point, the maximum point of pulsation of the subclavian artery was also ascertained. The position of the brachial plexus was determined with the help of a nerve locator pen. Just above and behind the subclavian pulse, a Stimuplex A, B Braun nerve locator needle was inserted backward and medially. When the desired twitch was observed, the current was reduced until muscle contractile responses started at 0.5 mA current level suggesting the location of the brachial plexus. The needle was secured firmly and after a proper suction, 1 ml of the local anesthetic solution was administered and the twitching ceased. This immediate disappearance of twitching is not due to the local anesthetic blocking the nerve but reflects the physical separation of the nerve from the needle tip.

An aspiration test for blood was performed to avoid intravascular drug injection. The necessary volume of the drug was injected at this point. Pulse and blood pressure were recorded preoperatively and immediately after the block was administered. Subsequently, pulse and blood pressure were recorded every 10 minutes during the operation and postoperatively until the local anesthetic effects completely wore off. The onset of sensory and motor blockade and the onset of analgesia were assessed every 2 minutes and compared with the corresponding areas of the opposite arm. Rescue analgesia was provided with tramadol 100 mg diluted in 100 ml of normal saline, and the number of doses given was recorded. The regression of the block was similarly monitored until complete recovery. Any side effects or complications during injection, surgery, and the postoperative period were documented and treated accordingly.

Statistical Analysis: Data were summarized as mean ± standard deviation or as percentages. Categorical variables between the two groups were compared using the Chi-square test or Fisher's exact test, as appropriate. Numerical variables were normally distributed and compared using the student's unpaired 't'-test. All analyses were two-tailed, and a P-value of <0.05 was considered statistically significant.

Results

A total of 40 cases divided equally into two groups were included in the study. Table 1 presents the demographic characteristics of two groups of patients. There are no statistically significant differences in age, sex, BMI, or mean duration of surgery between the two groups (p-value > 0.05). The results indicate that the two groups are well-matched in terms of demographic characteristics, suggesting that any observed differences in outcomes between the groups can be attributed to the study interventions (levobupivacaine with or without clonidine) rather than confounding factors related to patient demographics.

Table 1: Demographic profile of the study population.

Parameters	Group A (n=20) 30 ml of 0.5% levobupivacaine with 1 ml normal saline	Group B (n=20) 30 ml of 0.5% levobupivacaine with 0.3 ml clonidine (50 µg)	p-value
Age (years)	30.52 ± 10.95	33.19 ± 12.34	0.557
Male: Female	11: 9	12:8	0.881
BMI (kg/m2)	24.16 ± 2.92	24.19±1.83	0.995
Mean Duration of surgery (minutes)	99.25 min	92.67 min	0.159

Table 1 presents the demographic characteristics of two groups of patients. There are no statistically significant differences in age, sex, BMI, or mean duration of surgery between the two groups (p-value > 0.05). The results indicate that the two groups are well-matched in terms of demographic characteristics, suggesting that any observed differences in outcomes between the groups can be attributed to the study interventions (levobupivacaine with or without clonidine) rather than confounding factors related to patient demographics.

Table 2: Onset time and duration of motor and sensory block

Variables	Group A (n=20) 30 ml of 0.5% levobupivacaine with 1 ml normal saline	Group B (n=20)30 ml of 0.5% levobupivacaine with 0.3 ml clonidine (50 µg)	p-value
Onset of motor block (minutes)	17.09 ± 2.25	13.69 ± 2.91	0.04*
Duration of motor block (minutes)	605 ± 145.25	920.22 ± 139.33	0.0001*
Onset of sensory block (minutes)	10.19 ± 2.92	7.99 ± 1.82	0.02*
Duration of sensory block (minutes)	659.37 ± 142.33	950.32 ± 129.87	0.001*

* Significant

The onset of both motor and sensory blocks was significantly faster in Group B compared to Group A the p values were found to be significant. The duration of motor block and sensory block was significantly longer in group B as compared to group A indicated by significant p values. The data suggests that the addition of clonidine to levobupivacaine provides a faster onset and prolonged duration of both motor and sensory block.

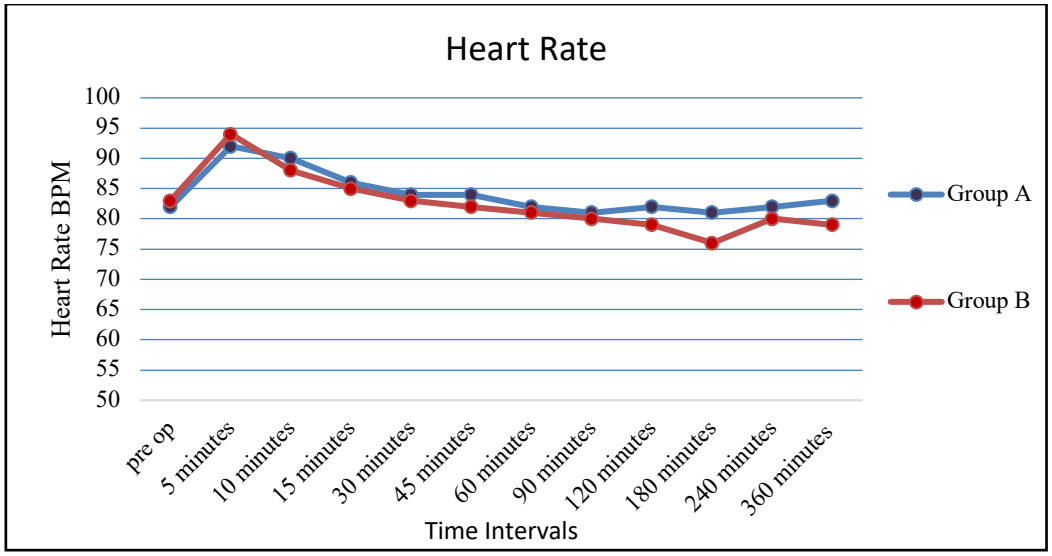

Figure 1: Comparison of mean heart rate in two groups at different intervals

Figure 1 shows the heart rate (bpm) for two groups (Group A and Group B) at various time points, ranging from pre-op to 360 minutes. From Figure 1 we found that both groups have a similar heart rate at baseline (pre-op). The heart rate increases slightly for both groups at 5 minutes and then starts to decrease gradually over time. Overall, Group A seems to have a slightly higher heart rate compared to Group B throughout the measurement period.

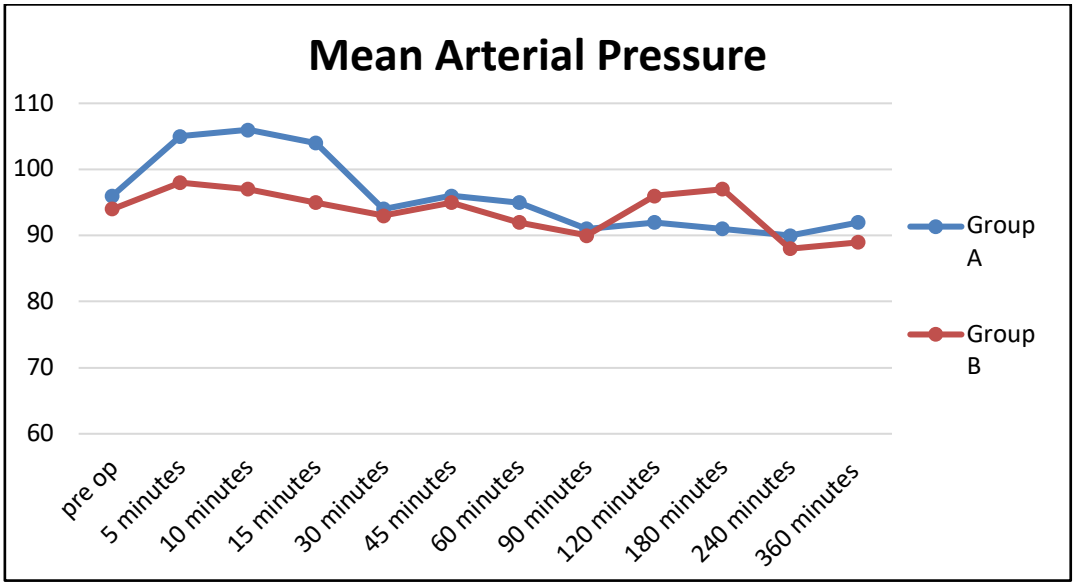

Figure 2: Comparison of mean arterial pressure recorded in both groups at different intervals

Figure 2 presents the mean arterial pressure (MAP) values for two groups, A and B, at various time points. The data spans from pre-operative (pre-op) to 360 minutes post-operative. Initial MAP: Both Group A and Group B have similar MAP values at the pre-operative stage. Post-operative Trend: Both groups exhibit a general trend of decreasing MAP over time following the procedure. Group Differences: While both groups show a similar pattern, Group A consistently displays slightly higher MAP values compared to Group B at most time points. The data suggests that the procedure had a similar impact on MAP for both groups, leading to a gradual decrease in blood pressure over time. However, Group A consistently maintained a slightly higher MAP compared to Group B.

Discussion

This study was conducted in the Department of Anesthesia at Prathima Institute of Medical Sciences on 40 cases undergoing upper limb surgeries. The findings from this randomized

controlled trial indicate that low-dose clonidine, when used as an adjuvant to 0.5% levobupivacaine in supraclavicular brachial plexus block, extends both the duration of analgesia and motor block. In this study, the sensory onset time was reduced in Group B, which received 50 µg of clonidine with levobupivacaine, showing a mean time of 7.99 ± 1.82 minutes. The onset of motor blockade occurred at 17.09 ± 2.25 minutes in Group A and 13.69 ± 2.91 minutes in Group B. The difference between the two groups was statistically significant ($p < 0.04$). Therefore, it can be concluded that the addition of 50 µg clonidine shortened the onset time, resulting in a faster onset of both sensory and motor block.

Various studies corroborate these findings (using 30 mL of 0.5% levobupivacaine). Moore et al. [7] noted that the time of onset and the establishment of maximum operative anesthesia significantly vary depending on the concentration and volume of the local anesthetic and the type of block performed. The results of our study are consistent with those of Aliye Esmaoglu et al. [8], who added dexmedetomidine (an α_2 agonist) to levobupivacaine for axillary brachial plexus block, demonstrating that it shortens the onset time for both sensory and motor block and extends the duration of the block and postoperative analgesia. However, our results differ from those of Sarita S. Swami et al. [9], who compared clonidine with dexmedetomidine as adjuvants to 35 cc of 0.25% bupivacaine for supraclavicular block, reporting an onset of sensory and motor blockade (clonidine group) at (2.33±1.2) and (3.87±1.78) minutes, respectively, which were too short. This discrepancy might be attributed to subtle pharmacological differences between the racemic and S (-)-enantiomer forms of bupivacaine.

Chakraborty et al. [10] evaluated clonidine as an adjuvant to bupivacaine in brachial plexus block, reporting that sensory and motor block onset was significantly faster with clonidine, supporting our findings. Several studies using clonidine in peripheral nerve blocks have found that clonidine with bupivacaine enhances analgesic properties compared to bupivacaine alone [11, 12]. A study by Duma et al. [13] reported sensory block onset times of [10(5-60) vs. 5(5-60) minutes] and motor block onset times of [10(5-120) vs. 10(5-180) minutes] using levobupivacaine alone and with 150µg clonidine. They noted no significant difference between levobupivacaine and bupivacaine in the onset or duration of axillary brachial plexus block. Their study found no significant differences in block duration with or without clonidine. However, they observed variability in block duration with clonidine and concluded that clonidine's effect as an adjuvant is inconsistent, leading to unpredictable block durations. Our study contradicts the findings of Duma et al. [13] as their study compared levobupivacaine with clonidine in an axillary plexus block, where the axillary space is larger than the supraclavicular space. Side effects such as nausea and vomiting were not significant issues in either Group A or Group B. Adverse reactions to levobupivacaine are similar to those seen with bupivacaine and other amide-class local anesthetics.

Conclusion

The results of this study suggest that levobupivacaine is an effective local anesthetic for supraclavicular brachial plexus block, offering a long duration of pain relief with minimal impact on hemodynamic variables. Adding 50 µg clonidine as an adjuvant to levobupivacaine prolongs the sensory and motor block duration while shortening the onset period. The drug alone or with clonidine results in minimal side effects of no clinical significance. We recommend incorporating clonidine as an adjuvant to local anesthetics. Further studies are needed to compare levobupivacaine alone and in combination with clonidine, especially in supraclavicular block contexts.

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