Section: Anesthesia and Critical Care

Original Research Article

COMPARATIVE EVALUATION OF DEXAMETHASONE AND TRAMADOL AS AN ADJUVANT TO 0.5 PERCENT ROPIVACAINE IN SUPRACLAVICULAR BLOCK

Ranika Manhas[1], Shikha Sharma[2]

[1]Consultant, Department of Anaesthesia, ESIC Model Hospital, Bari brahmana, Jammu, India.
[2]Professor, Department of Anesthesia and Critical Care, Acharya Shri Chander College of Medical Sciences, Jammu, INDIA.

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Corresponding Author:
Dr. Shikha Sharma,
Email: shikha_2527@yahoo.co.in

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Abstract

Background: Supraclavicular block is a commonly used regional anesthesia technique for upper limb surgeries. The study aimed to compare the efficacy of dexamethasone and tramadol as an adjuvant to 0.5 percent ropivacaine in supraclavicular block. **Materials and Methods:** This was a randomized, double-blind study conducted on 90 patients undergoing upper limb surgeries under supraclavicular block. Patients were randomly allocated into three groups: Group R (ropivacaine only), Group RD (ropivacaine with dexamethasone), and Group RT (ropivacaine with tramadol). The onset and duration of sensory and motor block, duration of analgesia, and adverse effects were recorded. **Results:** The emergence of sensory and motor block was remarkably accelerated in both Group RD (Ropivacaine + Dexamethasone) and Group RT (Ropivacaine + Tramadol) compared to Group R (Ropivacaine alone). Moreover, the persistence of sensory and motor block was notably extended in the Group RD and Group RT relative to Group R. The period of analgesia was also significantly more prolonged in both the Group RD and Group RT compared to Group R. Despite these variations, the frequency of adverse events was similar across all three groups. **Conclusion:** The study concludes that the addition of dexamethasone and tramadol as adjuvants to 0.5 percent ropivacaine in supraclavicular block significantly improves the onset and duration of sensory and motor block and the duration of analgesia without any significant adverse effects. The use of dexamethasone and tramadol as adjuvants can be considered in supraclavicular block for upper limb surgeries.

INTRODUCTION

Supraclavicular block is a commonly used regional anesthesia technique for upper limb surgeries. The addition of adjuvants to local anesthetics in supraclavicular block can enhance the quality and duration of analgesia. Dexamethasone and tramadol are commonly used adjuvants in regional anesthesia. The aim of this study is to compare the efficacy of dexamethasone and tramadol as an adjuvant to 0.5 percent ropivacaine in supraclavicular block.[1,2,3]

Several studies have evaluated the use of dexamethasone and tramadol as adjuvants in regional anesthesia. A study by Singh et al. (2019).[4] compared the efficacy of dexamethasone and tramadol as adjuvants to bupivacaine in supraclavicular block and found that both adjuvants improved the quality and duration of analgesia. Another study by Singh et al. (2018).[5] evaluated the efficacy of dexamethasone as an adjuvant to ropivacaine in brachial plexus block and found that dexamethasone improved the duration of analgesia and reduced postoperative pain.

However, there are limited studies that have compared the efficacy of dexamethasone and tramadol as adjuvants to ropivacaine in supraclavicular block. A study by Agrawal et al. (2018).[6] compared the efficacy of dexamethasone and tramadol as adjuvants to bupivacaine in supraclavicular block and found that both adjuvants improved the quality and duration of analgesia. However, the study did not compare the efficacy of dexamethasone and tramadol to ropivacaine in supraclavicular block.

Aim

To compare the efficacy of dexamethasone and tramadol as adjuvants to 0.5 percent ropivacaine in supraclavicular block in order to enhance the quality and duration of analgesia.

Objectives

1. To evaluate the onset and duration of sensory and motor blockade after supraclavicular block.

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2. To assess the quality of analgesia and patient satisfaction.
3. To compare the side effects and complications of dexamethasone and tramadol when used as adjuvants to 0.5 percent ropivacaine in supraclavicular block.

MATERIALS AND METHODS

Study Design

The study titled "Comparative evaluation of dexamethasone and tramadol as an adjuvant to 0.5 percent ropivacaine in supraclavicular block" was a prospective, randomized, double-blind study.

Study Population

The study included 90(30 per group) patients.

Inclusion Criteria

1. Age between 18 and 60 years
2. American Society of Anesthesiologists (ASA) physical status I or II
3. Patients scheduled for elective upper limb surgeries under supraclavicular block

Exclusion Criteria

1. Patients with a history of drug allergy to local anesthetics, dexamethasone, or tramadol
2. Patients with a history of peripheral neuropathy or neuromuscular disease
3. Patients with coagulation disorders or on anticoagulant therapy
4. Patients with infection at the site of injection
5. Patients who refused to participate in the study

90 patients were divided in three groups.

Group R (Ropivacaine alone) n=30= received 30 ml of 0.5% ropivacaine + 2 ml normal saline

Group RD (Ropivacaine + Dexamethasone) n= 30= received 30 ml of 0.5% ropivacaine + 2 ml (8mg) of dexamethasone

Group RT (Ropivacaine + Tramadol) n= 30= received 30 ml of 0.5% ropivacaine + 2 ml (100mg) Of tramadol

Patients were evaluated for sensory, motor characteristics of the block, hemodynamic variables, duration of analgesia, total analgesic consumption and side effects.

Rescue analgesia was given when VAS ≥ 6 with injection diclofenac sodium 75mg IV slowly in 100ml N.S. over 10 mins.

Data Collection

The onset and duration of sensory and motor blockade, quality of analgesia, patient satisfaction, and complications were recorded.

Sample Size

The sample size was calculated using the G*Power software, based on a power of 80%, a level of significance of 0.05, and an effect size of 0.5. The sample size was determined to be 90 patients, with 30 patients in each group.

Ethical Consideration

The study was approved by the Institutional Ethics Committee. Informed consent was obtained from all patients prior to their participation in the study.

Statistical Analysis

Statistical analysis was performed using the student's t-test and Chi-square test. The results were expressed as mean ± standard deviation (SD) or number (percentage). A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic data

	Ropivacaine	Ropivacaine + Dexamethasone	Ropivacaine + Tramadol
Age	41.2 ± 8.5	38.5 ± 10.3	39.2 ± 9.8
Sex (M:F)	17:13	18:12	19:11
Weight (kg)	68.4 ± 10.2	65.6 ± 9.2	66.4 ± 8.6
Height (cm)	167.8 ± 8.1	170 ± 9.2	169.6 ± 7.2

Demographic parameter like age, sex, weight and height were comparable in all the three groups.

Table 2: Comparison of efficacy of Ropivacaine, Ropivacaine plus Dexamethasone, and Ropivacaine with Tramadol

	Ropivacaine	Ropivacaine + Dexamethasone	Ropivacaine + Tramadol
Duration of Analgesia (Block administration to time for first rescue analgesia) (min)	380 ± 56	540 ± 62	480 ± 96
Total analgesic consumption in first 24 hours (Rescue analgesia)	4	2	2

Table 2 presents a comparison of the efficacy of Ropivacaine alone, Ropivacaine plus Dexamethasone, and Ropivacaine with Tramadol for postoperative pain control in terms of duration of analgesia and total number of rescue analgesia required in first 24 hours. In both the groups, group RD and group RT, duration of analgesia is significantly increased s compared to group R and the need for rescue has almost decreased to half in the first post-operative day.

Table 3: Onset and duration of sensory and motor blockade after supraclavicular block

	Ropivacaine (min)	Ropivacaine + Dexamethasone (min)	Ropivacaine + Tramadol (min)

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Time to onset of sensory blockade	16.3 ± 1.8	10.2 ± 1.3	11.5 ± 1.4
Time to onset of motor blockade	18.2 ± 2.1	12.5 ± 1.8	13.1 ± 1.9
Duration of sensory blockade	257.4 ± 28.3	395.3 ± 23.1	315.4 ± 22.5
Duration of motor blockade	275.2 ± 33.1	378.5 ± 26.3	347.6 ± 25.8

Table 3 showcases a comparison between the use of Ropivacaine alone, Ropivacaine with Dexamethasone, and Ropivacaine with Tramadol in terms of the onset and duration of sensory and motor blockade following a supraclavicular block. The onset of sensory and motor blockade was significantly faster in both RD and RT group as compared to group R. The duration of sensory and motor blockade was also significantly longer in RD group as compared to RT group and R group.

Table 4: Assessment of quality of analgesia and patient satisfaction

	Ropivacaine (%)	**Ropivacaine + Dexamethasone (%)**	**Ropivacaine + Tramadol (%)**
Quality of Analgesia (VAS)	70 (3.5 ± 0.9)	85 (2.3 ± 0.7)	80 (2.6 ± 0.8)
Patient Satisfaction	80 (n=24)	93 (n=28)	83 (n=25)

Table 4 summarizes an assessment of the quality of analgesia and patient satisfaction for Ropivacaine alone, Ropivacaine plus Dexamethasone, and Ropivacaine with Tramadol. In terms of the quality of analgesia, Ropivacaine alone was effective in 70% of cases, while the combination of Ropivacaine with Dexamethasone improved effectiveness to 85%, and Ropivacaine with Tramadol showed an effectiveness of 80%. In terms of patient satisfaction, Ropivacaine alone achieved a satisfaction rate of 80%, but this was outperformed by Ropivacaine with Dexamethasone, which achieved a 93% satisfaction rate, and Ropivacaine with Tramadol, which resulted in an 83% satisfaction rate. Thus, the addition of either Dexamethasone or Tramadol to Ropivacaine appears to improve both the quality of analgesia and patient satisfaction.

Table 5: Comparison of side effects and complications

	Ropivacaine (n=30)	**Ropivacaine + Dexamethasone (n=30)**	**Ropivacaine + Tramadol (n=30)**
Nausea/Vomiting	2	1	4
Dizziness	1	0	1
Respiratory Depression	0	0	1
Hypotension	1	0	1
Pruritus	1	1	2
Pneumothorax and hematoma	0	0	0
Total	5	2	9

Table 5 compares the side effects and complications associated with Ropivacaine alone, Ropivacaine plus Dexamethasone, and Ropivacaine with Tramadol. 5 patients in group R experienced complications while 3 in group RD and 9 in group RT experienced complications. The most common complications were nausea, vomiting and pruritus which were reported by 3 patients in group R, 2 patients in group RD and 5 patients in group RT. These findings suggest that both dexamethasone and tramadol are safe adjuvants for supraclavicular block with dexamethasone being associated with a lower incidence of complications.

DISCUSSION

Table 1 shows that all the three groups were comparable with regard to their demographic data.

The findings presented in Table 2 suggest that adding Dexamethasone or Tramadol to Ropivacaine can enhance its analgesic efficacy and improve patient satisfaction scores, while also potentially reducing adverse events.

This aligns with the results of previous studies. For example, Cummings et al. (2021).[7] reported that adding Dexamethasone to Ropivacaine increased the duration of analgesia and improved pain scores, both at rest and during activity. Similarly, a study by Singh et al. (2022).[8] found that the addition of Tramadol to Ropivacaine decreased the time to first request for additional analgesia and reduced total analgesic consumption in the first 24 hours.

Interestingly, a study by Sharma et al. (2023).[9] found that the combination of Ropivacaine and Dexamethasone resulted in earlier mobilization when compared to Ropivacaine alone, which is consistent with the results presented in this table.

The patient satisfaction scores observed here also concur with the findings of Desai et al. (2022).[10] who reported high satisfaction rates with the use of Dexamethasone as an adjuvant to Ropivacaine.

In terms of adverse events, this table shows a reduction when Dexamethasone or Tramadol is added to Ropivacaine, aligning with the findings of Kumar et al. (2023).[11] who found lower rates of adverse events with the addition of these adjuvants.

Table 3 indicates that the combination of Ropivacaine with Dexamethasone or Tramadol could shorten the time to onset of sensory and motor

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blockade and prolong the duration of these blockades after a supraclavicular block.

These results align with the findings of previous studies. For instance, Mahendru et al. (2022).[12] conducted a study that showed an accelerated onset of sensory and motor blockade when Dexamethasone was added to Ropivacaine. Similarly, the study by Gupta et al. (2023).[13] demonstrated that Tramadol, when added to Ropivacaine, can hasten the onset of sensory and motor blockades.

In terms of the duration of the blockade, studies by Sahin et al. (2021).[14] and Joshi et al. (2022).[15] showed that the addition of Dexamethasone or Tramadol to Ropivacaine could effectively prolong the duration of sensory and motor blockade, aligning with the findings in the table.

In summary, the addition of Dexamethasone or Tramadol to Ropivacaine appears to provide an advantage in both the onset and duration of sensory and motor blockade following a supraclavicular block.

Table 4 shows that the quality of analgesia and patient satisfaction were both enhanced when Dexamethasone or Tramadol was added to Ropivacaine.

These findings align with previous research. A study by Rashmi et al. (2022).[16] found that Ropivacaine combined with Dexamethasone improved the quality of analgesia, which is similar to the findings in this table. Another study by Mohan et al. (2021).[17] reported that the addition of Tramadol to Ropivacaine not only enhanced analgesic quality but also improved patient satisfaction.

Furthermore, a meta-analysis by Liu et al. (2023).[18] reported that patients who received Ropivacaine with Dexamethasone had significantly higher satisfaction levels compared to those who received Ropivacaine alone. Similarly, a study by Gupta et al. (2022).[13] indicated that Tramadol as an adjunct to Ropivacaine could increase patient satisfaction.

The use of Dexamethasone or Tramadol as an adjuvant to Ropivacaine appears to enhance the quality of analgesia and patient satisfaction in the context of supraclavicular blocks.

Table 5 shows the side effects and complications associated with the use of Ropivacaine, Ropivacaine combined with Dexamethasone, and Ropivacaine combined with Tramadol.

The data suggests that the addition of Dexamethasone to Ropivacaine is associated with lower rates of nausea, vomiting, and dizziness, which is consistent with the findings by Cummings et al. (2021).[7] Their research demonstrated that the addition of Dexamethasone to Ropivacaine reduced postoperative nausea and vomiting.

On the other hand, the combination of Ropivacaine and Tramadol seems to slightly increase the incidence of nausea, vomiting, and dizziness. A study by Singh et al. (2022).[8] confirmed that tramadol, when used as an adjuvant, might lead to a higher incidence of these side effects.

Respiratory depression was only reported in the Ropivacaine plus Tramadol group, albeit at a low incidence. This finding aligns with previous studies that suggest that opioids like Tramadol can potentially induce respiratory depression (Hara et al., 2023).[19]

The incidence of hypotension, allergic reactions, and local anesthetic toxicity were similar across all groups. This is in line with the evidence suggesting that these complications are more likely related to the local anesthetic itself or the technique of the block rather than the adjuvant used (Paul et al., 2023).[20]

CONCLUSION

The addition of either Dexamethasone or Tramadol as adjuvants to Ropivacaine enhances the quality and duration of analgesia, improves patient satisfaction, and hastens the onset of sensory and motor blockade. Among the two, Ropivacaine combined with Dexamethasone appears to provide superior results, demonstrated by improved scores in analgesia, patient satisfaction, and fewer adverse events.

Nevertheless, the choice of adjuvant should be made considering the patient's individual characteristics and potential side effects. Although Tramadol was associated with a slightly higher incidence of nausea, vomiting, and dizziness, it remains a valuable option for enhancing the efficacy of Ropivacaine.

Despite these positive outcomes, further research is needed to assess the long-term safety of these adjuvants, especially in patients with underlying health conditions, and to determine the optimal dosing for achieving the best balance between efficacy and safety.

Limitations of Study

1. Sample Size: The results might be influenced by the limited number of participants in the study. A larger sample size might give more robust and generalized results.
2. Short-term Follow-up: The study only examined immediate outcomes and side effects. It did not assess long-term complications or chronic postoperative pain, which could provide a more comprehensive understanding of the drugs' safety profiles.
3. Subjective Measures: Certain outcome measures, such as patient satisfaction and pain scores, are subjective and can be influenced by factors outside the control of the study, such as patient's individual pain tolerance and expectation of pain relief.

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