|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||

Available online on http://www.ijmbs.info

International Journal of Medical and Biomedical Studies; 2025; 9(2); 110-116

An Observational Study

Comparison of Supraclavicular Brachial Plexus Block with and without Dexamethasone as an Adjuvant to Local Anesthetics: An Observational Study

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Received: 19-01-2025 / Revised: 04-02-2025 / Accepted: 11-03-2025
DOI: https://doi.org/10.32553/ijmbs.v9i2.3058
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Conflict of interest: No conflict of interest

Abstract:

Background: Supraclavicular brachial plexus block (SCBPB) is a widely used regional anesthetic technique for upper limb surgeries. While local anesthetics provide effective analgesia, their limited duration often necessitates additional analgesics. Dexamethasone, a corticosteroid with anti-inflammatory properties, has been explored as an adjuvant to prolong block duration and enhance analgesic efficacy.

Aim: To compare the onset time, duration of block, postoperative pain scores, and analgesic consumption in supraclavicular brachial plexus block with and without dexamethasone.

Methods: This observational study included 60 patients undergoing elective upper limb surgeries, randomly divided into two groups of 30 each. Group 1 received local anesthetics (15 ml of 2% lignocaine with adrenaline and 15 ml of 0.5% bupivacaine) with 8 mg dexamethasone (2 ml). Group 2 received the same anesthetic combination with 2 ml normal saline. Data collected included block onset time, duration, pain scores (VAS), total analgesic consumption, and side effects. Statistical analysis was performed using SPSS v23, with $p < 0.05$ considered significant.

Results: Group 1 showed a significantly faster onset of sensory and motor block (6.2 ± 1.1 min and 8.0 ± 1.4 min) compared to Group 2 (9.1 ± 1.3 min and 11.2 ± 1.6 min, $p < 0.001$). The duration of sensory and motor blocks was also longer in Group 1 (645.6 ± 48.3 min and 598.7 ± 45.6 min) than in Group 2 (430.2 ± 39.4 min and 405.8 ± 36.2 min, $p < 0.001$). Postoperative VAS scores were consistently lower, and total analgesic consumption was significantly reduced in the dexamethasone group. No significant difference in adverse effects was observed between the groups.

Conclusion: Dexamethasone as an adjuvant to local anesthetics in SCBPB leads to faster onset, prolonged block duration, and better postoperative pain control without increasing adverse effects.

Recommendations: Larger randomized controlled trials are recommended to confirm these findings and to establish the optimal dexamethasone dose for peripheral nerve blocks.

Keywords: Supraclavicular brachial plexus block, Dexamethasone, Regional anesthesia, Postoperative pain, Local anesthetic adjuvant.

Introduction

Due to their benefits over general anesthesia, such as better postoperative analgesia, lower opioid usage, and fewer systemic problems, regional anesthesia techniques have become increasingly popular [1]. Because it offers efficient anaesthesia and analgesia for operations involving the arm, forearm, and hand, the SCBPB is one of the most used regional blocks for upper limb surgeries [2]. The duration of effect of SCBPB, which is contingent upon the pharmacokinetics of the local anesthetics employed, is its main drawback. By extending analgesia and lowering the requirement for postoperative opioids, adjuvants added to local anesthetics have been investigated as a way to improve the block's effectiveness [3].

A corticosteroid with strong analgesic and anti-inflammatory effects, dexamethasone has shown promise as an adjunct in regional anesthesia. When combined with local anesthetics, dexamethasone dramatically extends the duration of sensory and motor blocking and lessens postoperative pain, according to multiple studies [4,5]. Although the exact mechanism by which dexamethasone amplifies the effects of local anesthetics is unknown, it is thought to entail modulating nociceptive pathways, reducing perineural inflammation, and inhibiting prostaglandin synthesis [6]. Furthermore, dexamethasone may prolong the anesthetic effect by reducing the elimination of local anesthetics [7].

Despite the known benefits, concerns have been raised regarding the safety and potential neurotoxicity of perineural dexamethasone administration. While several randomized controlled trials and meta-analyses have reported no significant adverse effects, further research is warranted to establish its long-term safety profile [8,9]. Moreover, conflicting evidence exists regarding the optimal dose of dexamethasone for achieving maximal analgesic benefits without increasing the risk of systemic side effects [10]. The purpose of this study was to examine the length of sensory and motor block, onset time, postoperative pain alleviation, and analgesic consumption of supraclavicular brachial plexus block with and without dexamethasone as an adjuvant to local anesthetics.

Methodology

Study Design

This was an observational study.

Study Setting

The study was conducted at Deen Dayal Upadhyay Hospital, a tertiary care hospital equipped with an advanced anesthesia department. The hospital provided a wide range of surgical procedures and facilitated the recruitment of appropriate participants undergoing surgeries requiring a brachial plexus block.

Participants Each of the 60 patients in the study needed a supraclavicular brachial plexus block as a component of their scheduled surgery. Participants were split into two groups, one of which received only local anesthetic and the other of which received both local anesthetic and dexamethasone. These individuals were chosen from among those slated for regional anesthesia-assisted upper limb procedures at Deen Dayal Upadhyay Hospital. Prior to registration, each subject gave their informed consent.

Inclusion and Exclusion Criteria

Inclusion Criteria:

1. Adults who are 18 to 60 years old.
2. Elective upper limb surgery patients who need a supraclavicular brachial plexus block.
3. Patients who gave their informed consent and expressed a desire to participate.
4. Patients with physical status I and II of the ASA.

Exclusion Criteria:

1. Allergies to local anesthetics or dexamethasone.
2. Pregnancy or lactation.
3. History of cardiovascular, respiratory, or neurological disorders that might interfere with the study.
4. Inability to comply with study procedures.
5. Infections or inflammation at the site of injection.
6. Any history of bleeding disorders
7. Patients on anticoagulation medications
8. Local infection at the site where the block was to be administered
9. Neurological deficit involving the brachial plexus
10. Any history of allergy to local anesthetic drugs

Bias

Using a computer-generated randomization table, all patients were randomized to either the dexamethasone or non-dexamethasone group in order to reduce bias. The group allocation was concealed from the researchers who collected and analyzed the data. Additionally, the analysis adjusted for relevant confounders such patient demographics, anesthesia technique, and surgery type.

Data Collection

Data were collected at various time points throughout the perioperative period. The following parameters were recorded:

- Demographic details (age, gender, ASA classification).
- Time of onset of sensory and motor block.
- Duration of sensory and motor block.
- Postoperative pain scores (measured using the Visual Analog Scale or VAS).
- Total postoperative analgesic consumption.
- Any adverse effects associated with dexamethasone administration, including nausea, vomiting, or allergic reactions.

Procedure

There were two groups of thirty participants each.

1. **Group 1** received a local anesthetic (15 ml of 2% lignocaine with adrenaline and 15 ml of 0.5% bupivacaine), along with dexamethasone 8 mg (2 ml).
2. **Group 2** received a local anesthetic (15 ml of 2% lignocaine with adrenaline and 15 ml of 0.5% bupivacaine) along with 0.9% normal saline (2 ml).

Statistical Analysis

To analyze the data, SPSS version 23.0 was used. Clinical results and demographic traits were compiled using descriptive statistics. Independent t-tests for continuous variables and chi-square tests for categorical variables were used to compare the two groups' sensory and motor block onset and duration, pain levels, and painkiller intake. Statistical significance was defined as a p-value of less than 0.05. Descriptive statistics were used to identify and examine any negative impacts that were noticed.

Results

A total of 60 patients undergoing upper limb surgery under supraclavicular brachial plexus block were included in this observational study. They were randomly assigned into two groups:

- **Group 1 (Dexamethasone Group)**: Received local anesthetic with 8 mg dexamethasone.
- **Group 2 (Control Group)**: Received local anesthetic with 2 ml normal saline.

Table 1: Baseline Demographics

Parameter	Group 1 (n=30)	Group 2 (n=30)	p-value
Age (years)	38.6 ± 9.2	39.3 ± 8.7	0.74
Gender (M/F)	17 / 13	16 / 14	0.80
ASA Grade (I/II)	18 / 12	17 / 13	0.79
BMI (kg/m²)	23.8 ± 2.5	24.1 ± 2.8	0.68

There was no statistically significant difference in baseline characteristics between the two groups, confirming the groups were comparable.

Table 2: Onset of Sensory and Motor Block

Onset (minutes)	Group 1 (Dexamethasone)	Group 2 (Control)	p-value
Sensory Block Onset	6.2 ± 1.1	9.1 ± 1.3	<0.001
Motor Block Onset	8.0 ± 1.4	11.2 ± 1.6	<0.001

The addition of dexamethasone significantly reduced both sensory and motor block onset times. This faster onset leads to quicker surgical readiness.

Table 3: Duration of Sensory and Motor Block

Duration (minutes)	Group 1 (Dexamethasone)	Group 2 (Control)	p-value
Sensory Block Duration	645.6 ± 48.3	430.2 ± 39.4	<0.001
Motor Block Duration	598.7 ± 45.6	405.8 ± 36.2	<0.001

Dexamethasone prolonged the sensory block by ~215 minutes and motor block by ~193 minutes compared to control. This indicates a significant extension of the analgesic effect.

Table 4: Postoperative Pain (VAS) and Analgesic Use

Time Post-Op	VAS Score (Group 1)	VAS Score (Group 2)	p-value
2 hours	2.0 ± 0.5	3.7 ± 0.7	<0.001
4 hours	2.7 ± 0.6	5.2 ± 1.0	<0.001
8 hours	3.4 ± 0.7	6.0 ± 1.1	<0.001
12 hours	4.0 ± 0.9	6.7 ± 1.3	<0.001
Total Tramadol Used (mg)	**84.2 ± 12.5**	**138.7 ± 15.4**	**<0.001**

Pain scores were consistently lower in Group 1 at all postoperative time intervals, indicating superior analgesia. Analgesic consumption was significantly lower in the dexamethasone group.

Table 5: Adverse Events

Adverse Event	Group 1 (n=30)	Group 2 (n=30)	p-value
Nausea	2	3	0.64
Vomiting	1	1	1.00
Allergic Reaction	0	0	—
Local Site Infection	0	0	—

Both groups experienced minimal side effects, with no statistically significant differences. Dexamethasone was well-tolerated.

Key points

This observational study demonstrates that the addition of **dexamethasone (8 mg)** as an adjuvant to local anesthetics in supraclavicular brachial plexus block significantly improves the quality of regional anesthesia. Compared to the control group, patients receiving dexamethasone experienced:

1. A **faster onset** of both sensory and motor block (sensory: 6.2 ± 1.1 min vs. 9.1 ± 1.3 min; motor: 8.0 ± 1.4 min vs. 11.2 ± 1.6 min; $p < 0.001$), enabling **earlier surgical readiness**.
2. A **prolonged duration** of both sensory and motor block (sensory: 645.6 ± 48.3 min vs. 430.2 ± 39.4 min; motor: 598.7 ± 45.6 min vs. 405.8 ± 36.2 min).
3. **Lower postoperative pain scores** at all intervals (2, 4, 8, and 12 hours) and **reduced need for rescue analgesics** within 24 hours (84.2 ± 12.5 mg vs. 138.7 ± 15.4 mg; $p < 0.001$).
4. **No significant increase in adverse effects**, indicating a favorable safety profile.

Key Advantage: The **faster onset time** achieved with dexamethasone not only enhances patient comfort but also contributes to improved surgical workflow by reducing anesthesia preparation time.

Discussion

In this study, the addition of dexamethasone as an adjuvant to local anesthetics in supraclavicular brachial plexus block led to significant improvements in block performance and postoperative outcomes. Patients in the dexamethasone group experienced a faster onset of sensory and motor block compared to the control group, which is clinically beneficial as it enables earlier commencement of surgery. This faster onset enhances operating room efficiency and reduces waiting time for surgical teams.

Moreover, the duration of both sensory and motor blocks was significantly prolonged in the dexamethasone group. This extended anesthetic effect translated into better postoperative pain control, as reflected by consistently lower Visual Analog Scale (VAS) scores at 2, 4, 8, and 12 hours after surgery. Additionally, patients receiving dexamethasone required significantly less rescue analgesia, indicating improved patient comfort and a reduced need for opioids.

Importantly, the use of dexamethasone was not associated with any increase in adverse effects. Both groups reported minimal and comparable side effects such as mild nausea, with no incidents of serious complications like allergic reactions or local site infections. This highlights dexamethasone's favorable safety profile when used in peripheral nerve blocks.

Overall, the findings suggest that dexamethasone is a safe and effective adjuvant that enhances the quality of supraclavicular brachial plexus block by providing faster onset, longer duration, and better postoperative analgesia. Its routine use may contribute to improved perioperative care and greater patient satisfaction in upper limb surgeries.

The effectiveness of dexamethasone in prolonging and improving the quality of supraclavicular brachial plexus blocks has been repeatedly demonstrated by recent studies. Dexamethasone demonstrated superior performance without serious side effects when compared to clonidine. It showed a significantly faster onset of sensory (8.92 ± 3.72 min vs. 10.74 ± 2.38 min) and motor block (9.41 ± 2.78 min vs. 12.16 ± 2.26 min) with a longer analgesia duration (1012 ± 99.24 min vs. 649.8 ± 158 min) [11]. In a similar vein, dexamethasone demonstrated a longer duration of analgesia (1211.12 ± 111.22 min vs. 498.18 ± 64.44 min) and a quicker onset of sensory (13.20 ± 1.93 min vs. 15.88 ± 2.50 min) and motor block (17.44 ± 2.54 min vs. 19.26 ± 2.54 min) than magnesium sulfate [12].

The duration of motor block (918.75 ± 65.80 min vs. 632.60 ± 23.09 min) and postoperative analgesia (1051.00 ± 90.18

min vs. 811.12 ± 17.23 min) was significantly longer with dexamethasone than with dexamedetomidine, although the latter showed a slightly faster onset of sensory block (14.38 ± 2.19 min vs. 13.00 ± 1.89 min) [13]. In comparison to local anesthetics alone, dexamethasone was also observed to dramatically increase the onset and duration of sensory and motor blocks when administered to a mixture of bupivacaine and lignocaine with adrenaline [14].

Conclusion

The addition of dexamethasone (8 mg) to local anesthetics in supraclavicular brachial plexus block was found to significantly improve block characteristics. Patients receiving dexamethasone experienced a faster onset of both sensory and motor block, allowing for quicker surgical readiness. The block duration was also substantially prolonged, leading to better postoperative pain relief and a reduced need for analgesics within the first 24 hours. Importantly, the use of dexamethasone did not result in any significant increase in adverse effects, confirming its favorable safety profile. These findings support the use of dexamethasone as an effective and safe adjuvant in regional anesthesia for upper limb surgeries.

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