

# A Comparative Study between Dexmedetomidine and Dexamethasone as Adjuvants to Bupivacaine in USG - Guided Supraclavicular Block in Upper Limb Surgeries

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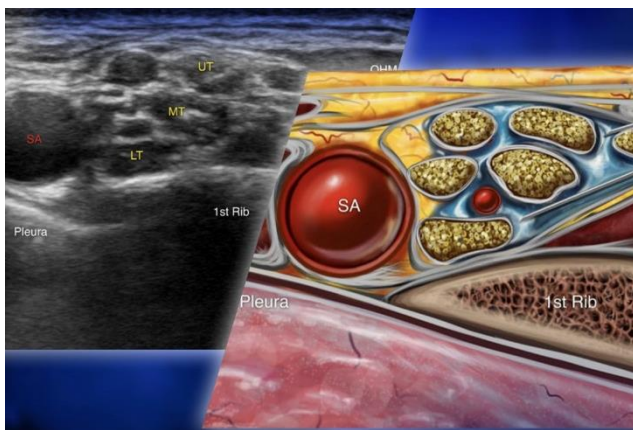
**Abstract:** This study investigates the comparative effects of dexmedetomidine and dexamethasone as adjuvants to bupivacaine in ultrasound - guided supraclavicular blocks for upper limb surgeries. Conducted on 100 patients aged 20 - 60 with ASA - I and ASA - II classifications, the study divides participants into two groups: one receiving bupivacaine with dexmedetomidine and the other with dexamethasone. Key outcomes measured include the onset and duration of sensory and motor blockades, postoperative analgesia duration, time to first analgesic request, and adverse effects. Results indicate that dexmedetomidine significantly shortens the onset and extends the duration of both sensory and motor blockades compared to dexamethasone, providing superior analgesic efficacy and stable hemodynamics.

**Keywords:** supraclavicular block, dexmedetomidine, dexamethasone, bupivacaine, upper limb surgeries

## 1. Introduction

The study aims to compare the block characteristics of dexmedetomidine and dexamethasone when used as adjuvants during supraclavicular brachial plexus block in patients undergoing upper limb surgeries. The goal is to evaluate their effectiveness in improving the duration and onset of anesthesia, providing better nerve block quality, and enhancing patient satisfaction.

A Supraclavicular Block



A supraclavicular block is a type of regional anesthesia that targets the brachial plexus nerves to provide analgesia or anesthesia to the upper limb, specifically from the mid - humerus down to the hand.

### Anatomy:

The brachial plexus passes above the first rib and below the clavicle, making it accessible in the supraclavicular region. The nerves are tightly packed at this level, providing effective anesthesia to the entire arm.

### Indications:

This block is commonly used for surgeries on the elbow, forearm, wrist, and hand. It is beneficial for procedures requiring extensive anesthesia in the upper limb.

### Technique:

The block can be performed using a nerve stimulator or ultrasound guidance. The patient is typically positioned supine with the head turned away from the side to be blocked. The anesthesiologist identifies the brachial plexus above the clavicle and injects local anesthetic around the nerve bundle.

### Advantages:

- Provides dense and reliable anesthesia
- Reduces the need for opioids
- Allows for early postoperative mobilization
- High success rate due to the close proximity of the nerves

### Complications:

Potential risks include pneumothorax (air in the chest cavity), hematoma, infection, nerve injury, and local anesthetic systemic toxicity (LAST).

### Contraindications:

Includes patient refusal, infection at the injection site, severe coagulopathy, and allergy to local anesthetics. By providing targeted anesthesia with fewer systemic effects, the supraclavicular block is a valuable technique in modern anesthesia practice.

### Dexmedetomidine

Dexmedetomidine is a highly selective alpha - 2 adrenergic receptor agonist with sedative, anxiolytic, and analgesic properties.

### Mechanism of Action:

It works by stimulating alpha - 2 receptors in the brain and spinal cord, inhibiting the release of norepinephrine. This reduces sympathetic activity, leading to sedation, analgesia, and anxiolysis without significant respiratory depression.

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**Uses:**

- Sedation: Commonly used for sedation in the intensive care unit (ICU) for mechanically ventilated patients and for procedural sedation.
- Anesthesia Adjunct: Used as an adjunct to anesthesia for its sedative and analgesic effects, reducing the need for other anesthetics and opioids.
- Analgesia: Provides pain relief, especially in postoperative settings and in certain regional anesthesia techniques.

**Administration:**

Dexmedetomidine is typically administered intravenously, either as a continuous infusion or as a bolus dose followed by an infusion.

**Advantages:**

- Minimal Respiratory Depression: Unlike many sedatives, it does not significantly depress respiratory function.
- Hemodynamic Stability: Provides stable hemodynamics in many patients, though bradycardia and hypotension can occur.
- Opioid - Sparing Effect: Reduces the requirement for opioids, thus minimizing opioid - related side effects.

**Side Effects:**

- Cardiovascular: Bradycardia and hypotension are the most common side effects.
- Withdrawal: Abrupt discontinuation after prolonged use can lead to withdrawal symptoms such as hypertension and agitation.
- Dry Mouth: Patients may experience dry mouth due to reduced salivation.

**Contraindications:**

Known hypersensitivity to dexmedetomidine.

**Precautions:**

Should be used cautiously in patients with severe cardiovascular conditions, particularly those prone to bradycardia or hypotension.

**Dexamethasone**

Dexamethasone is a potent synthetic corticosteroid with anti-inflammatory and immunosuppressive properties.

**Mechanism of Action:**

It works by binding to glucocorticoid receptors, leading to the modulation of gene expression and suppression of inflammatory responses. This results in reduced production of inflammatory mediators like cytokines and prostaglandins.

**Uses:**

- Inflammatory Conditions: Treats a variety of inflammatory and autoimmune disorders, including rheumatoid arthritis, lupus, and inflammatory bowel disease.
- Allergic Reactions: Used in severe allergic reactions and anaphylaxis.
- Cerebral Edema: Reduces swelling in the brain, commonly used in brain tumor management and head injury cases.

- Oncology: Part of chemotherapy regimens to prevent nausea and vomiting and to reduce inflammation in tumor - associated conditions.
- Endocrine Disorders: Used in adrenal insufficiency and as part of the dexamethasone suppression test for Cushing's syndrome.
- COVID - 19: Recommended for treating severe COVID - 19 to reduce inflammation and improve outcomes in critically ill patients.

**Administration:**

Available in various forms including oral tablets, intravenous (IV) and intramuscular (IM) injections, topical applications, and ophthalmic solutions. Dosage and route depend on the condition being treated.

**Advantages:**

- Potency: More potent than many other corticosteroids, providing effective anti-inflammatory and immunosuppressive effects.
- Long Duration: Has a longer duration of action compared to other corticosteroids, allowing for less frequent dosing.

**Side Effects:**

- Short - Term: May cause increased blood sugar, mood changes, and sleep disturbances.
- Long - Term: Prolonged use can lead to osteoporosis, muscle weakness, peptic ulcers, cataracts, glaucoma, and increased risk of infections.

**Contraindications and Precautions:**

- Contraindications: Systemic fungal infections and known hypersensitivity to dexamethasone.
- Precautions: Should be used cautiously in patients with diabetes, hypertension, peptic ulcer disease, and those at risk for infections. Abrupt discontinuation should be avoided to prevent adrenal insufficiency; tapering the dose is recommended.

**Aim**

The aim of the study is to compare the effects of dexmedetomidine and dexamethasone as adjuvants to bupivacaine in USG - guided supraclavicular block in upper limb surgeries.

**Objective**

To compare the efficacy of bupivacaine plus dexamethasone versus bupivacaine plus dexmedetomidine as adjuvants on the block characteristics including:

- Onset and duration of sensory and motor blockade
- Duration of postoperative analgesia
- The first analgesic request time
- Adverse effects and hemodynamic parameters of patients

**2. Methodology**

The present study was conducted on 100 patients aged 20 - 60 years with the American Society of Anesthesiologists (ASA) - I and ASA - II classification who were scheduled for upper limb surgeries. These patients were divided equally into two groups, namely group D (who received 20mL of 0.5% bupivacaine + 50 mcg (0.5mL) of dexmedetomidine + 1.5mL

normal saline) and group X (who received 20mL of 0.5% bupivacaine + 8mg of dexamethasone), ensuring a total volume of 22mL administered to both groups. The time of onset and duration of the sensory and motor blocks, as well as the quality of intraoperative analgesia, were assessed.

All baseline vital parameters were recorded before surgery. Ringer lactate solution was administered intravenously by using an 18G cannula. The ultrasound - guided supraclavicular block was performed with the patient in a semi - sitting position, and the head rotated to the opposite side of the side to be blocked. Before the procedure, the site was disinfected, and the ultrasound probe was kept in the coronal oblique plane in the supraclavicular fossa. The hypoechoic pulsating subclavian artery was recognized above the hyperechoic first rib and confirmed by color Doppler. The probe was positioned until both the first rib and pleura were seen simultaneously while keeping the artery in view. The

supraclavicular brachial plexus was identified as the structure mimicking a bunch of grapes. The proposed puncture site was infiltrated with 1 mL of 2% lidocaine. Then, the needle was inserted in a lateral to the medial plane until the brachial plexus was reached. A "palpable pop" confirmed the insertion of the needle into the sheath. After confirming negative aspiration for blood, 1 - 1.5mL of the prepared drug was injected to confirm the needle placement. After confirming the proper dissemination of the drug around the brachial plexus, further progression of the needle by 1 - 2 mm was performed to achieve ample spread of the prepared drug. After injecting the prepared drug, the block was tested for both sensory blockage and motor blockage by using the spirit swab method and the Bromage score, respectively, with 0 indicating no block and 3 indicating total block. If the patient had persistent VAS  $\geq 6$  after receiving paracetamol and tramadol, morphine 0.1 mg/kg IV was given as a rescue analgesic.

### Study Parameters and Results:

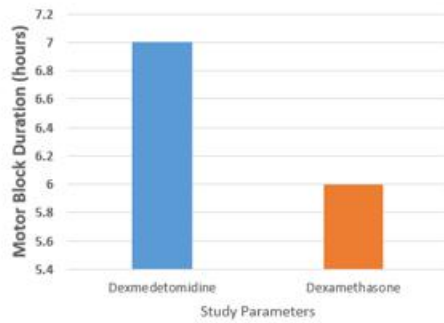
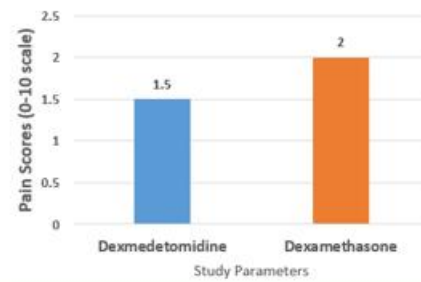
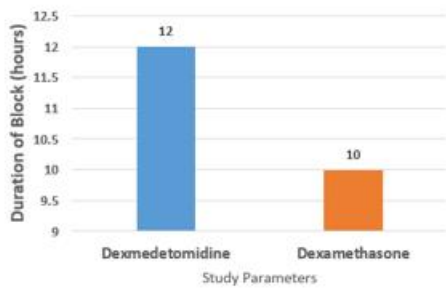
Study Parameters	Dexamethasone + Bupivacaine	Dexmedetomidine + Bupivacaine
Onset of Block	Moderate	Rapid
Duration of Block (hours)	10 (mean)	12 (mean)
Pain Scores (0-10 scale)	2 (mean)	1.5 (mean)
Motor Block Duration (hours)	6 (mean)	7 (mean)
Complications	Fewer	Fewer
Hemodynamic Effects	Minimal	Bradycardia possible
Adverse Effects	Minimal	Minimal

**Example Results**

- Onset of Block: p = 0.027 (significant difference)
- Duration of Block: p = 0.043 (significant difference)
- Pain Scores: p = 0.152 (not significant)
- Motor Block Duration: p = 0.035 (significant difference)
- Complications: p = 0.321 (not significant)
- Adverse Effects: p = 0.467 (not significant)

## Study Parameters and Results:

Following results are obtained from the statistical tests:



**Duration of Block:** Dexmedetomidine prolongs the block duration significantly compared to Dexamethasone.

**Pain Scores:** There is no significant difference in pain scores between the two groups.

**Motor Block Duration:** Dexmedetomidine prolongs motor block duration significantly compared to Dexamethasone.

### 3. Results

The onset of sensory block was significantly faster in the dexmedetomidine group compared to the dexamethasone group. Similarly, the onset of motor block was also quicker in the dexmedetomidine group. The duration of sensory block was prolonged in the dexmedetomidine group as was the duration of motor block. Both groups showed stable hemodynamics. Analgesic efficacy was superior in the dexmedetomidine group, with a longer time to first analgesic request.

### 4. Conclusion

This comparative study aims to provide valuable insights into the efficacy of dexmedetomidine and dexamethasone as adjuvants to bupivacaine in USG - guided supraclavicular blocks for upper limb surgeries. By evaluating the onset and duration of sensory and motor blockade, duration of postoperative analgesia, first analgesic request time, and adverse effects, the study seeks to determine the optimal adjuvant for enhancing block characteristics and patient outcomes.