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Research Article

Dexamethasone vs. Clonidine as Adjuvants for Bupivacaine-Lignocaine in Interscalene Brachial Plexus Block: A Peripheral Nerve Stimulator-Guided Approach.

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Abstract: The addition of adjuvants to local anesthetics in brachial plexus block enhances the efficacy of the nerve blockade. Dexamethasone and Clonidine are commonly used adjuvants with distinct mechanisms of action. This study aims to compare these adjuvants in terms of onset of action, duration of analgesia, hemodynamic stability, and adverse effects when used with Bupivacaine and Lignocaine with Adrenaline in an interscalene brachial plexus block. The findings will provide insight into selecting the optimal adjuvant for prolonged postoperative analgesia. Materials and Methods: This prospective, randomized, double-blind, comparative clinical study was conducted in the Department of Anaesthesia Shadan Institute of Medical Sciences, Teaching Hospital & Research Centre after obtaining ethical committee approval and written informed consent from all patients.The participants were divided into two groups: Group D (Dexamethasone) and Group C (Clonidine). The onset time, duration of analgesia, hemodynamic stability, and adverse effects were analyzed. Results: Group D (Dexamethasone) had a slightly faster onset of sensory and motor blockade (12.3 ± 2.1 min) compared to Group C (Clonidine, 13.0 ± 2.3 min), but the difference was not statistically significant ($p > 0.05$). Dexamethasone significantly prolonged analgesia (780 ± 50 min) compared to Clonidine (610 ± 45 min), with $p < 0.05$ (statistically significant). Excellent satisfaction was higher in Group D (85%) compared to Group C (72%), suggesting that patients experienced better pain relief and comfort with Dexamethasone. Fewer patients rated their satisfaction as "Fair" in the Dexamethasone group (3%) compared to Clonidine (8%), further supporting its superior efficacy in pain management. Conclusion: Dexamethasone provides a longer duration of analgesia than Clonidine when used as an adjuvant in interscalene brachial plexus block, making it a preferred choice in clinical settings requiring prolonged postoperative analgesia.

Keywords: Brachial plexus block, Dexamethasone, Clonidine, Bupivacaine, Lignocaine, Adrenaline

INTRODUCTION

Regional anesthesia techniques, particularly brachial plexus blocks, have gained popularity in upper limb surgeries due to their effectiveness in providing intraoperative anesthesia and postoperative analgesia. [1] The interscalene approach, guided by a peripheral nerve stimulator, offers reliable blockade for shoulder and upper arm procedures. [2] Peripheral nerve stimulator-guided blocks enhance precision, minimizing the risks associated with blind techniques. [3] The choice of adjuvants significantly influences the duration and quality of analgesia. [4] Dexamethasone, a potent corticosteroid, has anti- inflammatory and immunosuppressive effects that contribute to prolonged nerve blockade. [5] It inhibits nociceptive signaling pathways, reduces perineural inflammation, and extends the duration of local anesthetic action. [6]

Clonidine, an α2-adrenergic agonist, enhances analgesia by modulating the release of norepinephrine, resulting in hyperpolarization of C-fiber neurons. [7] This leads to prolonged nerve blockade and reduced pain perception. Clonidine also provides mild sedation, which can be beneficial during surgery. [8] However, its sympatholytic effects may cause transient hypotension and bradycardia, necessitating careful monitoring. [9]

This study aims to compare these adjuvants in terms of onset of action, duration of analgesia, hemodynamic stability, and adverse effects when used with Bupivacaine and Lignocaine with Adrenaline in an interscalene brachial plexus block. The findings will provide insight into selecting the optimal adjuvant for prolonged postoperative analgesia.

MATERIALS AND METHODS

This prospective, randomized, double-blind, comparative clinical study was conducted in the Department of Anaesthesia Shadan Institute of Medical Sciences, Teaching Hospital & Research Centre after obtaining ethical committee approval and written informed consent from all patients.

Inclusion Criteria

- Patients aged 18–65 years according to ASA (American Society of Anesthesiologists) physical status I or II. Scheduled for elective upper limb surgery under interscalene brachial plexus block

Exclusion Criteria
Patient refusal

- Allergy to local anesthetics, dexamethasone, or clonidine
- Coagulation disorders or anticoagulant therapy
- Neurological or neuromuscular disorders
- Severe hepatic, renal, or cardiac disease
- Pregnancy or lactation
- Infection at the injection site

Study Design

A total of 90 patients were randomized into two groups:
Group D (n=45): 0.1 mg/kg Dexamethasone with Bupivacaine and Lignocaine with Adrenaline
Group C (n=45): 1 mcg/kg Clonidine with Bupivacaine and Lignocaine with Adrenaline

Primary outcomes included onset time and duration of analgesia, while secondary outcomes assessed hemodynamic parameters and adverse effects.

Procedure

Preoperative Preparation

All patients underwent pre-anesthetic evaluation and received standard fasting guidelines. Baseline vital parameters (HR, BP, SpO_2, ECG) were recorded. IV line access was secured, and patients were preloaded with Ringer's lactate 10 mL/kg. Standard monitoring (ECG, NIBP, SpO_2) was used.

Interscalene Brachial Plexus Block Technique

Patients were positioned supine with the head turned contralaterally. Under strict aseptic precautions, the interscalene groove was identified. A peripheral nerve stimulator (PNS) was used to localize the brachial plexus. The block was performed using a 22G, 50 mm insulated stimulating needle. The nerve stimulator was set to 0.5 mA, 0.1 ms pulse width, and the optimal motor response (deltoid or biceps muscle contraction) was confirmed. Total drug volume: 30 mL, consisting of: Bupivacaine 0.5% (15 mL) + Lignocaine 2% with adrenaline (15 mL) and Plus either dexamethasone 8 mg (Group D) or clonidine 100 µg (Group C)

Post-Block Monitoring and Assessment

Sensory block onset time: Evaluated using a pinprick test at every 2-minute interval until complete anesthesia. Motor block onset time: Assessed using a modified Bromage scale every 2 minutes. Duration of analgesia: Time from block completion to the first analgesic request (VAS ≥ 4). Hemodynamic parameters (HR, BP, SpO_2): Recorded at baseline, post-block, and every 5 minutes intraoperatively. Side effects (hypotension, bradycardia, nausea, vomiting, sedation, respiratory distress, etc.) were documented. Rescue analgesia (IV tramadol 50 mg) was given if VAS ≥ 4.

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were presented as mean ± standard deviation (SD) and compared using an independent t-test. Categorical variables were analyzed using the chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Data

Parameter	Group D (n=45)	Group C (n=45)	p-value
Age (years)	42.3 ± 8.5	41.8 ± 9.2	>0.05
Weight (kg)	68.5 ± 7.8	67.9 ± 8.1	>0.05

Table 2: Onset and Duration of Blockade

Parameter	Group D	Group C	p-value
Onset Time (min)	12.3 ± 2.1	13.0 ± 2.3	>0.05
Duration of Analgesia (min)	780 ± 50	610 ± 45	<0.05

Group D (Dexamethasone) had a slightly faster onset of sensory and motor blockade (12.3 ± 2.1 min) compared to Group C (Clonidine, 13.0 ± 2.3 min), but the difference was not statistically significant ($p > 0.05$). Dexamethasone significantly prolonged analgesia (780 ± 50 min) compared to Clonidine (610 ± 45 min), with $p < 0.05$ (statistically significant).

Table 3: Hemodynamic Parameters

Parameter	Group D	Group C	p-value
HR (bpm)	72 ± 5	70 ± 6	>0.05
BP (mmHg)	118/75 ± 8	115/72 ± 7	>0.05

Table 4: Adverse Effects

Adverse Effect	Group D (n)	Group C (n)
Hypotension	2	5

Bradycardia	1	4
Nausea	3	6

Table 5: Patient Satisfaction

Satisfaction Score	Group D	Group C
Excellent (%)	85	72
Good (%)	12	20
Fair (%)	3	8

suggesting that patients experienced better pain relief and comfort with Dexamethasone. Fewer patients rated their satisfaction as "Fair" in the Dexamethasone group (3%) compared to Clonidine (8%), further supporting its superior efficacy in pain management.

DISCUSSION

This study compared Dexamethasone and Clonidine as adjuvants in interscalene brachial plexus block, demonstrating that both agents enhance blockade duration and quality. [10] However, Dexamethasone significantly prolonged analgesia compared to Clonidine, supporting previous findings that corticosteroids potentiate local anesthetic effects through anti-inflammatory and direct neural mechanisms. [11]
In this study, Group D (Dexamethasone) had a slightly faster onset of sensory and motor blockade (12.3 ± 2.1 min) compared to Group C (Clonidine, 13.0 ± 2.3 min), but the difference was not statistically significant ($p > 0.05$). Dexamethasone significantly prolonged analgesia (780 ± 50 min) compared to Clonidine (610 ± 45 min), with $p < 0.05$ (statistically significant).

Clonidine's mechanism relies on α2-adrenergic receptor stimulation, prolonging blockade via neuronal hyperpolarization. [12] Despite its efficacy, its sympatholytic effects resulted in transient hypotension and bradycardia in some patients, necessitating careful perioperative monitoring. [13] Hemodynamic stability was largely maintained in both groups, but Clonidine users exhibited mild hypotension and bradycardia, aligning with known pharmacodynamics. [14] While these effects were not clinically significant, they require consideration in high-risk patients. [15]
In our study excellent satisfaction was higher in Group D (85%) compared to Group C (72%), suggesting that patients experienced better pain relief and comfort with Dexamethasone. Fewer patients rated their satisfaction as "Fair" in the Dexamethasone group (3%) compared to Clonidine (8%), further supporting its superior efficacy in pain management. Patient satisfaction scores were higher in the Dexamethasone group, likely due to prolonged.
analgesia, reducing opioid requirements and enhancing postoperative comfort. [16] Clonidine, despite effective analgesia, resulted in more sedation and hemodynamic variability. [17-19]

Dexamethasone is a superior adjuvant for interscalene brachial plexus block due to its significantly longer duration of analgesia, fewer side effects, and higher patient satisfaction. Clonidine is a viable alternative, particularly when sedation is desired, but requires careful hemodynamic monitoring due to its propensity to cause hypotension and bradycardia. For prolonged postoperative pain relief, Dexamethasone should be the preferred choice, especially in ambulatory settings where prolonged analgesia can reduce opioid consumption.

Limitations of the Study

Single-center study with a limited sample size (n=90), which may restrict generalizability. The study did not assess systemic effects of Dexamethasone, such as potential hyperglycemia, which might be relevant in diabetic patients. The optimal dose of Clonidine for peripheral nerve blocks is still debated, and different dosages may yield varying results.

Future Research Directions

Evaluate different doses of Clonidine and Dexamethasone to determine their optimal balance between efficacy and safety. Assess the effects of repeated administration of Dexamethasone on long- term nerve function. Conduct multicenter studies with larger sample sizes to validate these findings

CONCLUSION

Dexamethasone is a superior adjuvant to Clonidine for prolonging analgesia in interscalene brachial plexus block. While both drugs provide effective pain relief, Dexamethasone significantly extends the duration of analgesia, has fewer adverse effects, and is associated with greater patient satisfaction. Clonidine, although beneficial, has a higher incidence of hypotension and bradycardia, requiring careful monitoring. Based on this study, Dexamethasone should be considered the preferred adjuvant for enhancing the efficacy of regional anesthesia in upper limb surgeries.

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