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Research Article

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A Comparative Study of Ultrasound-Guided Infraclavicular Block with Bupivacaine Alone or Bupivacaine Combined with Dexmedetomidine for Postoperative Analgesia in Upper Limb Surgeries

Dr. Vikaskumar G. Vasava[2], Dr Saumil Shah[2], Dr. Jagruti R. Satasia[2], Dr. Vismit Gami[1*]

[1]*Smt. NHL Municipal Medical College, Ahmedabad, India*

[2]*Department of Anaesthesia, Shardaben General Hospital, NHLMMC, Ahmedabad, Gujarat, India*

[*]Corresponding Author
Dr. Vismit Gami, Smt. NHL Municipal Medical College, Ahmedabad, India.

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Abstract

This study aimed to compare the efficacy of ultrasound-guided infraclavicular block using Bupivacaine alone versus Bupivacaine combined with Dexmedetomidine for postoperative analgesia in upper limb surgeries. A total of 60 patients were randomly divided into two groups: Group A received 0.5% Bupivacaine, and Group B received 0.5% Bupivacaine with 0.75 µg/kg Dexmedetomidine. The primary outcomes measured were the onset and duration of sensory and motor block, as well as the duration of analgesia. Results showed that Group B had a significantly faster onset and longer duration of sensory and motor block, as well as prolonged analgesia compared to Group A. No complications were observed in either group. These findings suggest that the addition of Dexmedetomidine improves the effectiveness of infraclavicular blocks for postoperative analgesia.

Keywords: Infraclavicular Block, Dexmedetomidine, Bupivacaine, Ultrasound-Guided Anesthesia, Postoperative Analgesia.

1. Introduction

Peripheral nerve block not only provide excellent intraoperative analgesia but also provide good postoperative analgesia, reduction in stress response and systemic analgesic requirements.

Upper limb surgery is mostly performed under brachial plexus block which are given by various approaches, one of which is infraclavicular block for anaesthesia and analgesia for upper limb surgeries.

Various adjuvant like Dexamethasone, Dexmedetomidine, clonidine is used to prolong duration of analgesia of nerve block.

2. Aims and Objectives

This study was conducted to compare and evaluate effect of Dexmedetomidine as an adjuvant to Bupivacaine alone in infraclavicular brachial plexus block for upper limb surgery.

Patients were observed for following parameters –

2.1. Primary Objective

- Total duration of analgesia in both groups

2.2. Secondary Objective

- Onset and duration of sensory block
- Onset and duration of motor block
- Complications

3. Methodology

A prospective observational study was conducted at Smt. Shardaben General Hospital, Ahmedabad, after obtaining approval from the hospital's Institutional Review Board (IRB). The study enrolled 60 patients, aged 18 to 60 years, with an American Society of Anesthesiologists (ASA) physical status classification of grade I or II, who were scheduled to undergo upper limb surgeries.

3.1. Exclusion Criteria

Patients with ASA grade III or higher, pregnant females, individuals with bleeding disorders, those with known hypersensitivity to local anesthetics or adjuvants, patients with preexisting neuropathy, and those with a local infection at the proposed injection site were excluded from the study.

3.2. Preoperative Protocol

All participants underwent a pre-anesthetic evaluation, and the procedure was thoroughly explained to them one day prior to surgery. Patients were instructed to remain nil by mouth overnight prior to the procedure. In the operating theatre, a 20G intravenous cannula was inserted, and baseline measurements of pulse, blood pressure, oxygen saturation, and respiratory rate were recorded.

3.3. Study Groups

Patients were randomly assigned into two groups, with 30 patients in each group.

- **Group A:** 25 ml of 0.5% Bupivacaine (dose not exceeding the toxic limit of 3 mg/kg of the drug).
- **Group B:** 25 ml of 0.5% Bupivacaine with 0.75 µg/kg of Dexmedetomidine.

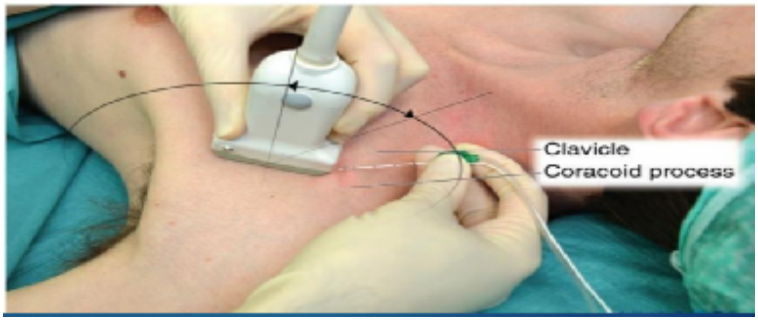
The randomized allocation ensured the study's impartiality and aimed to assess the comparative effectiveness of the two anesthetic regimens.

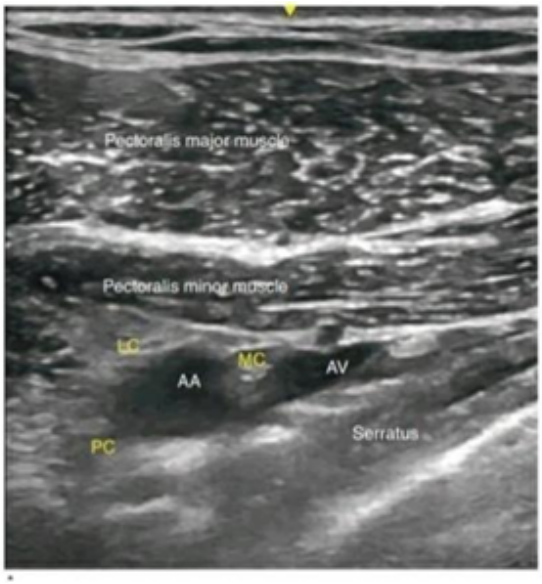
3.4. Technique

Under all aseptic precautions and patients in supine position, their head turned away from the side to be blocked and arm abducted at 90º . The high frequency probe of ultrasound machine (8-12 MHz) was positioned in parasagital plane just medial to coracoid process and inferior to clavicle.

After locating Axillary artery and vein just beneath sheath of pectoralis minor muscle and medial ,lateral and posterior cords appearing caudal , cephalic and posterior to the artery , respectively are located.

After aspiration to avoid unintentional intra vascular injection, test dose of 1-2 ml of 1% lidocaine and epinephrine, followed by loading dose of local anaesthetic administered.





Ultrasound Image of Infraclavicular Brachial Plexus AA-Axillary Artery, AV-Axillary Vein, LC-Lateral Cord, PC-Posterior Cord, MC- Medial Cord

3.5. Duration of Blocks and Analgesia

- **Onset and Recovery of Sensory Block:** The duration was defined as the time from the onset of the sensory block to the recovery of pinprick sensation.
- **Onset and Recovery of Motor Block:** The time from the onset of motor block to the recovery of motor function, assessed according to the Modified Bromage Scale (Grade 1), was recorded.

3.6. Modified Bromage Scale

Motor block recovery was assessed using the Modified Bromage Scale (Grade 1). This scale is used to grade the level of motor block during the postoperative period.

	SENSORY	MOTOR
Grade 0	No Block (normal sensation)	Normal motor function with full flexion and extension of elbow, wrist and fingers.
Grade 1	Partial Block	Decreased motor strength with ability to move the fingers only.
Grade 2	Complete Block	Complete motor block with inability to move fingers.
Onset	decrease of sensation to touch and pinprick to 25% or less by comparison to the contralateral limb.	the time from injection of local anaesthetic to reduction in motor power accordingly to Modified Bromage scale grade 1.
Duration	the time from onset of sensory block to recovery from pinprick sensation	the time from onset of motor block to recovery of motor function according to Modified Bromage scale. (Grade 1)

Modified Bromage Scale

3.7. Duration of Analgesia

The duration of analgesia was defined as the time from the onset of Grade 1 sensory block to the requirement for the first dose of rescue analgesia.

3.8. Postoperative Monitoring

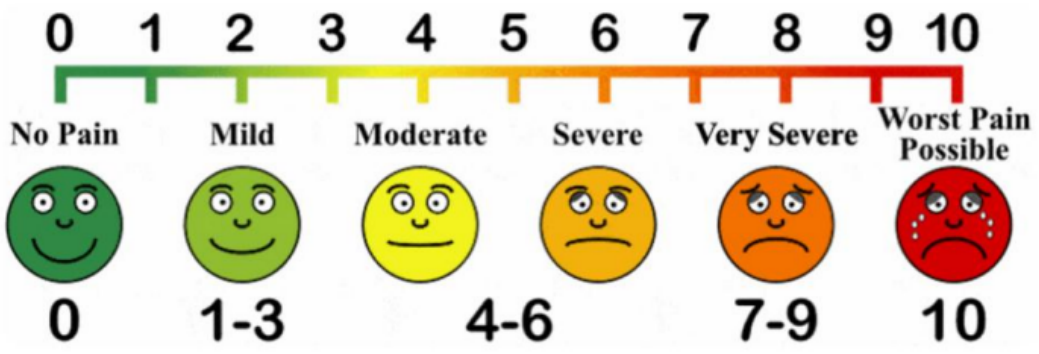
Postoperative monitoring was conducted at the following intervals:

- Every 30 minutes for the first 6 hours.
- Every hour from 6 to 10 hours.
- Every 2 hours until 24 hours post-surgery.

The postoperative duration of sensory block, motor block, and analgesia was assessed. Patients were also evaluated using the Visual Analogue Scale (VAS) for pain assessment.

3.9. VAS Score

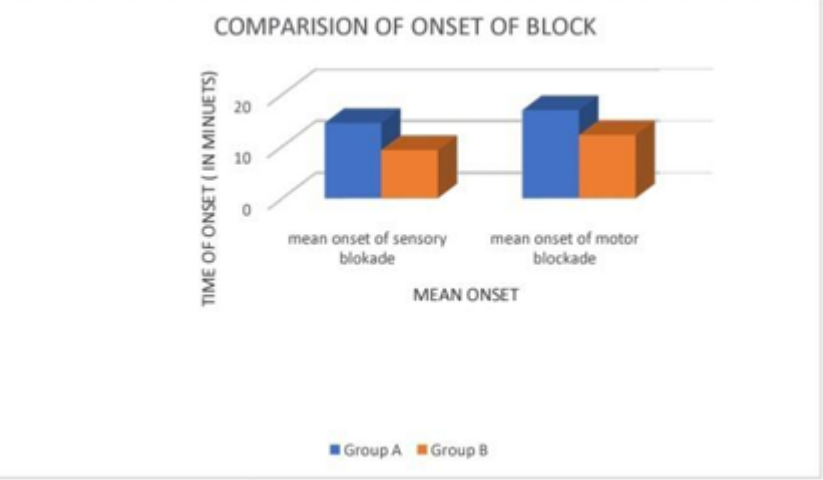
Postoperative pain intensity was assessed using the Visual Analogue Scale (VAS), which is a commonly used method for quantifying pain levels in patients.



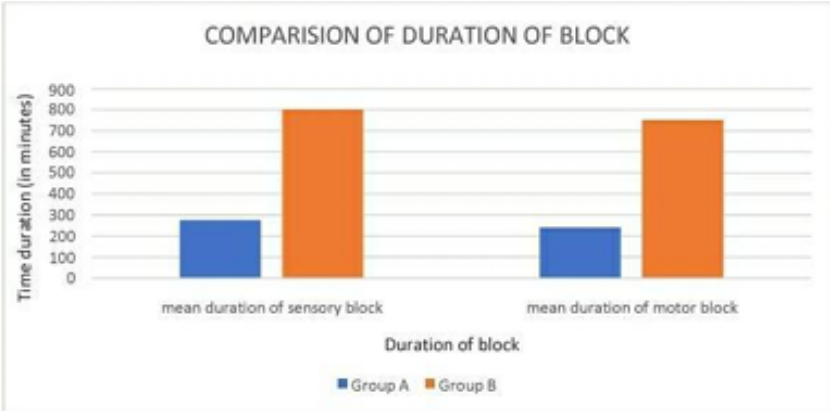
VAS Score Chart

3.10. Statistical Analysis

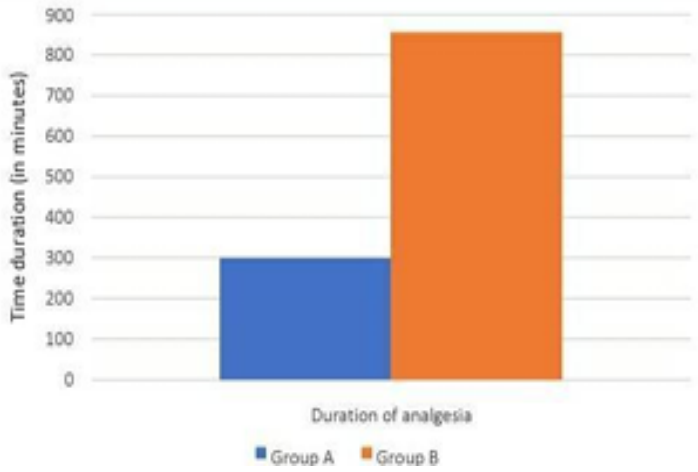
Descriptive data of both the groups were compared using unpaired 't' tests. 'P' value <0.05 was considered statistically significant and <0.001 was considered highly significant.



Comparison of Mean Sensory and Motor Onset



Comparision of Duration of Sensosry and Motor Blockade



Comparison of Duration of Post-Op Analgesia

3.11. Results

	Group A (N=30)	Group B(N=30)	p value	Inference
Gender **Male** **Female**	 20 (66.67%) 10 (33.33%)	 21 (70%) 9 (30%)	-	-
Age (years)	37.4 ± 14.35	34.4 ± 12.81	0.3693	NS
Weight (kgs)	58.83 ± 8.12	55.6 ± 6.59	0.0959	NS
Duration of surgery (mins)	104.33 ± 12.09	108.17 ± 13.1	0.2435	NS

Demographic data

	GROUP A	GROUP B	P value
Onset of sensory block	14.5 ± 0.93	9.28 ± 0.83	<0.0001
Onset of motor block	16.98 ± 0.93	12.18 ± 0.95	<0.0001
Duration of sensory block	276 ± 53.08	800 ± 166.82	<0.0001
Duration of motor block	240 ± 54.01	751 ± 164.41	<0.0001
Duration of post-op analgesia	299.33 ± 75.13	856.17 ± 174.71	<0.0001

4. Discussion

In our study, the total duration of analgesia in Group A was 299.33 ± 75.13 minutes, while in Group B it was 856.17 ± 174.71 minutes.

Ahmed A. Metwally et al. (14), in their study on infraclavicular block, used a control group with 0.5% Bupivacaine and another group with 100 µg of Dexmedetomidine combined with Bupivacaine. They observed that the total duration of analgesia in the control group was 246.3 ± 35.5 minutes, while in the group with Dexmedetomidine as an adjuvant, it was 809.2 ± 95.8 minutes. These findings are similar to our study.

Khaled M. Mahmoud (10) observed that the duration of analgesia in the group using plain Bupivacaine for an infraclavicular block was 255 ± 126 minutes. However, they used 0.325% Bupivacaine (30 ml) in their study.

It is evident that Group B, receiving the adjuvant Dexmedetomidine, demonstrated a faster onset of sensory and motor block, longer duration of both sensory and motor block, and a prolonged duration of analgesia compared to Group A, which received only plain Bupivacaine without any adjuvant.

5. Conclusion

This study concludes that the onset of sensory and motor block is significantly faster in the Dexmedetomidine group compared to the plain Bupivacaine group. The duration of both sensory and motor block is significantly longer with the addition of Dexmedetomidine as an adjuvant. Additionally, the duration of analgesia is significantly extended in the Dexmedetomidine group compared to Bupivacaine alone.

The use of ultrasound guidance, in addition to improving the success rate, also reduces complications such as accidental

arterial puncture, Horner's syndrome, and pneumothorax. No complications were observed in this study.

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