

A Comparison Between Dexamethasone + Buprenorphin and Dexamethasone + Dexmedetomidine as A Dual Adjuvant in Supraclavicular Brachial Plexus Block for Upper Limb Surgery

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Abstract

Background and Aims: Perineural adjuvants when used as a part of Supraclavicular Brachial Plexus Block will maximize the quality and duration of analgesia of the nerve blocks. In the present study, we compared the duration of postoperative analgesia and postoperative Requirement of rescue analgesia for two groups comprising either Dexamethasone + Buprenorphin and Dexamethasone +Dexmedetomidine as A Dual Adjuvant in the upper limb surgeries performed under ultrasound- guided (US- guided) supraclavicular brachial plexus blocks. **Materials and Methods:** In this Randomised comparative clinical study 40 patients randomly divided in two groups. Each group contains 20 patients. GROUP 1: inj. Bupivacaine (0.25%) 30ml+inj.Buprenorphine 0.5ml+inj.Dexamethasone 1 ml. GROUP 2: Inj.Bupivacaine (0.25%) 30ml+inj.dexamethasone 1ml+inj.Dexmedetomidine0.5ml. volume not exceeding 31.5ml. Intraoperative standard monitoring including ECG, SpO₂, PR and noninvasive blood pressure were done. Intravenous access was secured with 18-G cannula on the contralateral hand and 0.04 mg/kg midazolam was administered to all patients as a premedication and oxygen was delivered via facemask at a rate of 6 lit/min. **Results:** Postoperative duration of sensory blockade between Buprenorphine+ Dexamethasone and Dexmedetomidine+Dexamethasone contains significant P value (<0.001) and Postoperative duration of motor blockade between Buprenorphine+Dexamethasone and Dexmedetomidine+Dexamethasone contains significant P value (<0.001). Postoperative Requirement of rescue analgesia for two groups with P Value(0.06). **Conclusion:** For surgeries under USG Guided Supraclavicular brachial plexus block, perineural Dexmedetomidine+Dexamethasone when used as a dual adjuvant provided a prolonged duration of postoperative sensory and motor blockade and less requirement of postoperative rescue analgesia.

Key words: Analgesia, buprenorphine, dexmedetomidine, dexamethasone supraclavicular.

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Introduction

Pain, after orthopedic surgeries, can be intense and associated with neuroendocrine response, catecholamine release, and increased morbidity. Regional techniques have been suggested to produce better analgesia compared to systemic opioids, decrease the adverse side effects of narcotics, and increase the degree of patient's satisfaction. Supraclavicular block can provide analgesia for the upper extremity surgery. Prolonging the duration of sensory and motor block of regional anesthetic technique provides adequate anesthesia for prolonged surgeries and produces pain relief in the postoperative period.

Methods

This study was conducted from January 2022 to June 2022 at Govt.Thiruvavur Medical College hospital. The permission to conduct this study was taken from the hospital ethical committee. Informed written consent was taken and patients who gave the consent to participate in the study were included.

Inclusion Criteria

- Age 18 – 60 years.
- Either sex.
- American society of Anaesthesiologist (ASA) physical status I-II.

Exclusion Criteria

- Patient refusal
- Patients with history of allergy to local anesthetics
- Obesity
- Peripheral vascular disease
- Coagulopathy
- Infection at site of injection
- Neuropathy
- Pregnancy
- Incomplete blockade

Statistics

Table 1: Comparison of duration of sensory blockade (in hours)

| | Min | Max | Mean | SD | Median | IQR | p-value |
|--|-----|-----|------|-----|--------|--------|------------------|
| Group A (n=20) | 14 | 20 | 16.8 | 1.7 | 16.8 | 16, 18 | <0.001 |
| Group B (n=20) | 18 | 23 | 20.7 | 1.6 | 21.0 | 19, 22 | |
| Group A: Buprenorphin + Dexamethasone; Group B: Dexmedetomidine + Dexamethasone Min- Minimum, Max- Maximum, SD- Standard deviation, IQR- Inter-quartile range Independent t-test used; p-value <0.05 is significant; | | | | | | | |

Table 2: Comparison of duration of motor blockade (in hours)

| | Min | Max | Mean | SD | Median | IQR | p-value |
|---|------|------|------|-----|--------|----------|------------------|
| Group A (n=20) | 13.5 | 18 | 15.6 | 1.4 | 16.0 | 14, 16.9 | <0.001 |
| Group B (n=20) | 16 | 21.5 | 18.9 | 1.6 | 19.0 | 17.5, 20 | |
| Group A: Buprenorphin + Dexamethasone; Group B: Dexmedetomidine + Dexamethasone | | | | | | | |

Min- Minimum, Max- Maximum, SD- Standard deviation, IQR- Inter-quartile range
Independent t-test used; p-value <0.05 is significant;

Table 3: Requirement of rescue analgesia between groups

| Rescue analgesia | Group A (n=20) | | Group B (n=20) | | χ^2 | p-value |
|---------------------|-------------------|------|-------------------|------|----------|---------|
| | No | % | No | % | | |
| Not required | 13 | 65.0 | 18 | 90.0 | 3.6 | 0.06 |
| Inj. Paracetamol | 7 | 35.0 | 2 | 10.0 | | |

Pearson's Chi-square test used;
p-value <0.05 is significant;

Results and Discussion

Effective and appropriate pain management requires a proactive approach using a variety of treatment modalities targeting various phases of nociceptive pain processes such as transduction, transmission, perception and descending, and local modulation. It is proven that, the addition of various opioid and nonopioid adjuvants to local anesthetics in nerve blocks results in better pain control in the postoperative period. Polomano et al stated that the likelihood of central sensitization is prevented by completely blocking afferent signals from the surgical incision with the help of systemic pharmacological therapy. We used perineural adjuvants to improve postoperative analgesia. According to Elvir- Lazo et al. multimodal analgesia regimens are procedure- specific and may include combinations of systemic analgesics (eg., opioids, acetaminophen, nonsteroidal anti- inflammatory drugs, magnesium sulfate, lidocaine, ketamine, dexamethasone, and $\alpha 2$ - agonists), neuraxial analgesia, local infiltration, and peripheral nerve blocks.

Both perineural buprenorphine and dexmedetomidine have shown to potentiate the analgesic efficacy of local anesthetics. It is proposed that opioids have local anesthetic- like action on nociceptive neurons, thus explaining their analgesic efficacy in nerve blocks. Dexmedetomidine, a $\alpha 2$ - agonist acts on $\alpha 2$ adrenergic receptors in the dorsal horn of spinal cord and locus coeruleus and modulates the release of substance P to produce analgesic effects. Along with centrally mediated analgesia, $\alpha 2B$ - adrenoceptor mediated vasoconstrictive effects and attenuation of an inflammatory response, it has also a direct action on peripheral nerves.

In a study by Paliwal et al., the duration of analgesia of supraclavicular brachial plexus block was significantly prolonged by perineural buprenorphine (822.8 ± 417.5 min). Sarkar et al. found prolonged duration of postoperative analgesia after supraclavicular brachial plexus block in buprenorphine group (698.6 ± 189.5 min) than in the fentanyl group. Singam et al. used buprenorphine in supraclavicular brachial plexus block and found significant prolongation of postoperative analgesia (901.3 ± 60.0 min). In our study, the mean duration of analgesia was 937.6 ± 179.1 in the perineural buprenorphine group.

Esmaoglu et al. reported the prolonged duration of postoperative analgesia of axillary brachial plexus block due to addition of dexmedetomidine to levobupivacaine. Ammar et al. also found prolongation of the duration of postoperative analgesia after perineural dexmedetomidine in US- guided infraclavicular brachial plexus block. We found an extended duration of postoperative analgesia and reduced requirement of rescue analgesics (RA) in the first 24 hours and next 24 hours in Group II than in Group I. Sivakumar et al. also compared these two drugs as adjuvants to bupivacaine for brachial plexus block and reported prolonged duration of postoperative analgesia in dexmedetomidine group.

The sensory and motor block onset times were significantly shortened in the group comprising dexmedetomidine. Zangh et al. used dexmedetomidine perineurally for axillary brachial plexus block and found dose- dependent quicker onset of sensory and motor blocks. We also observed significantly longer duration of sensory and motor block in Group II than in Group I. Esmaglu et al. and Agarwal et al. also reported a prolonged block duration after perineural dexmedetomidine.

Local anesthetics used neuraxially or perineurally block only neuronal pathways but they do not block the humoral biochemical (inflammatory) responses that occur during surgery. Many neurotransmitters including substance P are released locally as well as centrally in response to surgical trauma leading to non- neuronal pain (insensible sensations). Drugs such as NSAIDs and dexamethasone, promote the release of anti- inflammatory mediators which the body produces to counteract the inflammatory mediators. Dexamethasone is a synthetic glucocorticoid with high potency, long duration of action and low mineralocorticoid activity. Its possible analgesic effect is through the inhibition of white cell aggregation at the endothelial level. Desmet et al. stated that dexamethasone increases postoperative analgesia to a similar duration whether given intravenously or perineurally.

In our study, Group II population reported prolonged analgesia than Group I, showing more effectivity of α_2 agonists than the opioid agonist- antagonist in brachial plexus block. The incidence of adverse effects noted was very low and was statistically insignificant in either group. The Ramsay sedation score was significantly high in Group II as compared to Group I, though it was always less than three in all the patients in either group. Gurajala et al. also reported sedative effects of perineural dexmedetomidine after supraclavicular brachial plexus block. The inhibition of noradrenergic activity via activation of α_2 receptors at the locus coeruleus, produces sedation that mimics nonrapid eye- movement sleep.

In the present study, all the study patients were hemodynamically stable, although HR and SBP in Group II were on the lower side than in Group I. But no patient developed clinically significant bradycardia and hypotension. Abdallah et al. in his meta- analysis of facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block, reported reversible bradycardia in 7% of brachial plexus block patients. Postsynaptic activation of central α_2 adrenoceptors leading to decreased sympathetic activity, might be the reason for decreased heart rate and blood pressure following the use of dexmedetomidine.

Conclusion

To conclude, dexmedetomidine and dexamethasone dual adjuvant combination provides good efficacy in prolonging the duration of sensory and motor blockade than dexmedetomidine and buprenorphine dual adjuvant combination.

Declaration of patient consent

The authors certify that they have obtained all Appropriate patient consent forms. In the form, the Patient(s) has/have given his/her/their consent for His/her/their images and other clinical information to Be reported in the journal. The patients understand That their names and initials will not be published and Due efforts will be made to conceal their identity, but Anonymity cannot be guaranteed.

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Conflicts of interest -There are no conflicts of interest.

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