Section: Anaesthesiology

Original Research Article

EFFICACY OF LOW DOSE INTRAVENOUS DEXAMETHASONE FOR THE PROLONGATION OF ANALGESIA IN SUPRA CLAVICULAR BRACHIAL PLEXUS BLOCK

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Corresponding Author:
Dr. Thiruvenkadam Selvaraj,
Email: mail2drthiru@yahoo.co.in

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Govindaraju Sudarmani[1], Thiruvenkadam Selvaraj[1], Arun Thilak E[1], Aishwarya Ramesh[1]

[1]Department of Anaesthesiology, Karpagam Faculty of Medical Sciences and Research, Coimbatore, Tamil Nadu, India

Abstract

Background: The supraclavicular brachial plexus block is a widely used technique for providing analgesia during upper limb surgeries. However, the duration of analgesia with bupivacaine alone is often limited, prompting the use of adjuncts to extend its effectiveness. Dexamethasone, administered intravenously, is one such adjunct that has shown promise in prolonging the duration of both sensory and motor blocks, as well as postoperative pain relief. This study was conducted to assess the efficacy of low-dose intravenous dexamethasone (4mg) in enhancing analgesia in patients undergoing surgery under supraclavicular block. **Materials and Methods:** A total of 50 patients with ASA grade I or II undergoing upper limb surgeries were randomly divided into two groups. Group A received bupivacaine alone, while Group B received bupivacaine with intravenous dexamethasone. The primary outcomes measured were the onset and duration of sensory and motor blocks, as well as postoperative pain relief. **Result:** The age and sex distribution between the two groups is statistically similar. The onset of sensory and motor block is faster in Group A (6.2±1.09 minutes) compared to Group B (9.4±0.89 minutes) ($p < 0.001$). The duration of the block is much longer in Group B (11.86±0.77 hours) compared to Group A (7.14±0.99 hours) ($p < 0.001$). The most notable difference is seen in the duration of analgesia, where Group B experienced analgesia for 13.7±0.97 hours compared to 6.7±0.83 hours in Group A. ($p < 0.001$). **Conclusion:** The study findings suggest that intravenous dexamethasone significantly prolongs the duration of both sensory and motor blocks and improves postoperative pain control compared to bupivacaine alone.

INTRODUCTION

The supraclavicular brachial plexus block is a commonly used regional anaesthesia technique for upper limb surgeries. Supraclavicular block is an inexpensive technique and provides a safe as well as better intraoperative and postoperative analgesia, by blocking the brachial plexus nerves.[1] However, the duration of analgesia provided by a standard nerve block is often limited, necessitating the use of adjuncts to prolong its effects and enhance patient comfort during the postoperative period. One such adjunct is dexamethasone, a corticosteroid that has shown promise in prolonging the duration of analgesia when administered as part of a peripheral nerve block.[2.3] Various studies had used perineural and intravenous dexamethasone for prolongation of analgesia in supraclavicular block.[4,5]

Dexamethasone reduces the prostaglandin production responsible for inflammation and pain via inhibiting synthesis of cyclooxygenase-2 in the peripheral tissues and central nervous system.[6,7] Dexamethasone can be administered through various routes, including perineural or intravenous (IV).[8] The perineural route has been traditionally used, but concerns regarding potential neurotoxicity have sparked interest in the intravenous administration of dexamethasone as a safer alternative.[9] Recent studies suggest that even low doses of IV dexamethasone may significantly prolong the duration of analgesia without the risk of nerve damage associated with direct perineural injection.[10,11,12] The efficacy of low-dose IV dexamethasone as an adjunct to supraclavicular brachial plexus blocks has become an area of focus for anaesthesiologists seeking to optimize postoperative pain control.[13] This approach offers the potential for longer-lasting analgesia, reduced opioid consumption, and improved patient outcomes, while minimizing the risks associated with higher

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doses or perineural administration. This study aims to evaluate the efficacy of low-dose intravenous dexamethasone in prolonging analgesia following a supraclavicular brachial plexus block. By investigating the analgesic duration and postoperative pain control in patients receiving this adjunct, we hope to provide insight into a potentially safer and more effective method for enhancing nerve block analgesia in upper limb surgeries.

MATERIALS AND METHODS

The study was conducted in a medical college teaching hospital. It is a tertiary referral hospital. It is an interventional study. The following inclusion criteria's used to select the patients. 1.ASA 1 & ASA 2 patients, 2. Patient undergoing upper limb surgery under supraclavicular brachial plexus block, 3. Patients willing to participate in study and giving valid consent. The exclusion criteria are 1. Patients who did not give consent, 2. Patient who are ASA 3 and 4, 3. history allergy to local anaesthetics. The qualified patients will be explained about the procedure in detail. In operation theatre, after all standard monitors were applied, an intravenous assess was secured with 18G or 20 G intravenous cannula. Patients of group A were given 1 ml of normal saline and patient of group B were given one ml of dexamethasone (4 mg) intravenously, before giving the supraclavicular brachial plexus block. In supine position with head turned to the opposite side and pillow kept under shoulder, under aseptic precautions, supraclavicular block was performed. A linear probe used to locate the brachial plexus. A 22 Gauge block needle was directed to the bundle of hypoechoic round nodules of brachial plexus just posterior and superficial to the subclavian artery and drug was injected. The anaesthesiologist providing the intravenous test drug together with anaesthesiologist responsible for the intraoperative and postoperative evaluation were blinded to the identity of the drugs used.

Patients were assessed at 3 min intervals for 15 min for the development of sensory and motor block. Sensory block was assessed by pinprick method using a blunt 24 G needle along the course of major peripheral nerves and graded as

0 = no block (normal sensation)

1 = partial block (decreased sensation)

2 = complete block (no sensation).

The motor block onset was considered to the inability to move patients fingers or raise hand. Modified Bromage scale used to assess the motor block of upper limb and graded as

0 = full motor power

1 = decrease motor power with ability to move the finger only

2 = complete motor block with inability to move fingers

Intra-operatively, no analgesic was supplemented. During surgery, adequate analgesia was assessed by absence of pain, hemodynamic stability, as indicated an increase in heart rate and systolic blood pressure of no more than 15% compared with baseline values. An increase in heart rate and systolic blood pressure within 20 min of skin incision along with pain indicated failure of supra clavicular brachial plexus block. The duration of postoperative analgesia was assessed by visual analog scale, every hourly for the first 10 hours and then every two hours for the next 24 hours. The score of >4 was considered to wear of the analgesic action and injection tramadol 50 mg IV was given as rescue pain relief. Patient details and all data will be collected and entered in MS Excel. Statistical analysis will be done using open epi and SPSS statistical software version 26.

RESULTS

The data in the [Table 1] compares the demographic characteristics between two groups, Group A and Group B. The age distribution between the two groups is statistically similar, with Group A having an average age of 44±15.86 years and Group B 41.2±12.72 years (p=0.766). Both groups have the similar sex distribution. However, significant differences are observed in the time of onset and duration of both sensory and motor blocks, as well as the duration of analgesia. The onset of sensory and motor block is faster in Group A (6.2±1.09 minutes) compared to Group B (9.4±0.89 minutes), with a highly significant p-value of <0.001. Moreover, the duration of the block is much longer in Group B (11.86±0.77 hours) compared to Group A (7.14±0.99 hours), also with a p-value of <0.001, indicating a substantial difference.

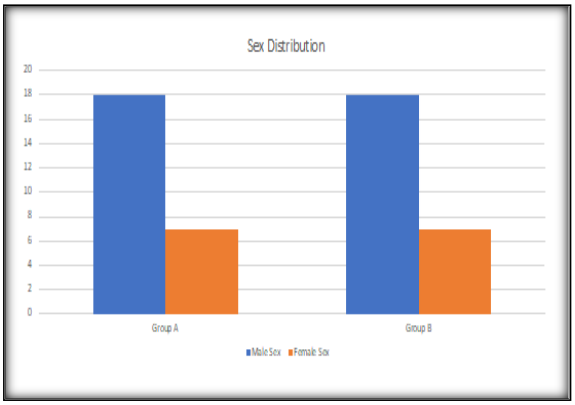

Figure 1: Demographic data

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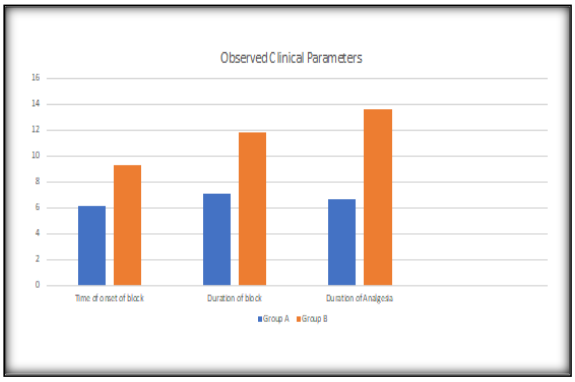

Figure 2: Observed Clinical Parameters

The most notable difference is seen in the duration of analgesia, where Group B experienced analgesia for 13.7±0.97 hours compared to 6.7±0.83 hours in Group A, with a highly significant p-value of <0.001. This suggests that the intervention used in Group B (likely the use of intravenous dexamethasone) significantly prolonged both the duration of the block and the duration of analgesia compared to Group A. These results underscore the efficacy of the adjunct in enhancing the clinical outcomes of the supraclavicular brachial plexus block.

Table 1: Demographic data.

Patient Characteristics	Group A (n=25)	Group B (n=25)	p value
Age	44±15.86	41.2±12.72	0.766
Sex (Male: Female)	18:7	18:7	-

Table 2: Observed Clinical Parameters

Patient Characteristics	Group A (n=25)	Group B (n=25)	p value
Time of onset of sensory, motor block (min)	6.2±1.09	9.4±0.89	<0.001*
Duration of Block (Hrs.)	7.14±0.99	11.86±0.77	<0.001*
Duration of Analgesia (Hrs.)	6.7±0.83	13.7±0.97	<0.001*

*Significant at 1% level

DISCUSSION

The results of this study demonstrate the efficacy of low-dose intravenous dexamethasone in prolonging the duration of both sensory and motor blocks, as well as postoperative analgesia, in patients undergoing upper limb surgeries under supraclavicular brachial plexus block. The comparison between Group A (without dexamethasone) and Group B (with dexamethasone) revealed statistically significant differences in the duration of analgesia, block duration, and onset time. The onset of sensory and motor block was notably slower in Group B, which received intravenous dexamethasone, with a time of 9.4±0.89 minutes compared to 6.2±1.09 minutes in Group A. This delayed onset may be attributed to the systemic effects of dexamethasone rather than a direct impact on the peripheral nerves. Despite this slower onset, the overall efficacy of dexamethasone in prolonging block duration was significant, as evidenced by the longer duration of the block in Group B (11.86±0.77 hours) compared to Group A (7.14±0.99 hours), suggesting the ability of dexamethasone to enhance the anaesthetic effect of bupivacaine.

The most pronounced effect was seen in the duration of analgesia, which was nearly doubled in Group B (13.7±0.97 hours) compared to Group A (6.7±0.83 hours). This prolongation of analgesia highlights the potential benefits of intravenous dexamethasone in extending pain relief, reducing the need for postoperative opioids, and improving overall patient comfort during the recovery period.

A study by Desmet et al found that perineural dexamethasone significantly prolonged analgesia when compared to placebo.[12] Pogatzki-Zahn et al described the mechanisms of dexamethasone in prolonging the duration of peripheral nerve blocks.[5] However, concerns about potential neurotoxicity from perineural administration, as raised in animal studies by Williams et al, which led to an exploration of intravenous dexamethasone as an alternative route.[6]

A systematic review by Kirkham et al found that both perineural and intravenous dexamethasone extended the analgesic duration of peripheral nerve blocks.[4] Interestingly, no significant difference in the duration of analgesia was observed between the perineural and intravenous routes, supporting the hypothesis that intravenous dexamethasone can be as effective as perineural administration, without the associated risks of nerve injury.

Current literature suggests that IV administration is comparable to perineural routes, providing a safer alternative for extending analgesia duration.

Chong et al found that patients receiving low-dose intravenous dexamethasone experienced a significant reduction in pain scores and a longer duration of sensory blockade compared to a control group.[1] Additionally, a meta-analysis by Huynh et al concluded that dexamethasone's effect on prolonging analgesia is dose-dependent, with higher doses providing longer effects but also increasing the risk of side effects such as hyperglycaemia.[3]

Low-dose dexamethasone (typically 4–8 mg) has been shown to reduce pain scores and opioid consumption postoperatively.

The findings are consistent with previous studies that suggest intravenous dexamethasone significantly enhances the effects of regional anaesthesia by

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reducing inflammation and extending the duration of nerve blocks. Furthermore, the safety profile of intravenous dexamethasone is favourable compared to perineural administration, as it reduces the risk of potential neurotoxicity.

CONCLUSION

The addition of low-dose intravenous dexamethasone to supraclavicular brachial plexus blocks provides a clear benefit in prolonging the duration of both sensory and motor blocks and postoperative analgesia. Although it causes a minor delay in the onset of the block, the extended pain relief is highly advantageous, especially in surgeries where prolonged postoperative analgesia is desired. These results support the use of intravenous dexamethasone as a safe and effective adjunct for enhancing the clinical outcomes of regional anaesthesia in upper limb surgeries. Further studies with larger sample sizes are needed to confirm these findings and optimize the dosing regimen for maximizing both safety and efficacy.

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