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Original Research Article

Comparative Study of the first Request for Rescue Analgesia and the Total Analgesic Requirement Postoperatively in Brachial Plexus Block with and without Dexamethasone as an Adjunct to Ropivacaine

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Abstract:

Introduction: A brachial plexus block is the most preferred procedure for upper limb surgeries. Adjuncts, when given with local anaesthetics, prolong the analgesic efficacy of the block. The aim is to compare patients receiving supraclavicular brachial plexus block with and without perineural dexamethasone to the following: 1. First request for rescue analgesia. 2. Total post-operative analgesic consumption within 24 hours.

Methods: Sixty patients with physical status ASA I and II, aged 18 to 50 years of both sexes, were randomly allocated into two groups of thirty. Group A received a supraclavicular block with 0.5% ropivacaine (30 ml) and 1ml(4mg) dexamethasone perineurally and 1ml 0.9%normal saline intravenously. Group B received a supraclavicular block with 0.5% ropivacaine(30ml) and 1ml 0.9%normal saline perineurally and 1 ml (4mg) dexamethasone intravenously. The duration of the sensory blockade was noted in both groups.

Results: The duration of analgesia in group A was found to be longer than in group B. The time for rescue analgesia in group A was 874.87 ±41.09 min compared to group B's 615.17 ±39.69 min, with a p-value of 0.001. And the average consumption of analgesic (Inj. Tramadol-1 mg/kg) post-operatively up to 24 hours in group A (86.7 ±31.60 mg) was less than that in group B (151.4 ±32.66 mg).

Conclusions: In supraclavicular brachial plexus block, dexamethasone given as adjuvant perineurally significantly delays the time of first request of rescue analgesia and decreases the total postoperative analgesic requirement.

Keywords: supraclavicular brachial plexus block, ropivacaine, dexamethasone, tramadol, perineural, intravenous.

Introduction

The supraclavicular brachial plexus block is the most used procedure for upper limb surgeries. Local anaesthetics along with adjuvants prolong the duration of analgesia. It inhibits the voltage-gated sodium-channels in neuronal membranes, resulting in a peripheral nerve block. Dexamethasone is being used as an adjunct in supraclavicular block, leading to less pain and a reduced opioid requirement post-operatively. [1] Dexamethasone decreases the release of inflammatory mediators and ectopic neuronal discharge and inhibits potassium channel–mediated discharge of nociceptive C fibres. [2] Therefore, we conducted this study to observe how significantly perineural dexamethasone can delay the first request for rescue analgesia and reduce the total analgesic requirement in supraclavicular block.

Methods:

With prior permission and approval from the Institutional Ethics Committee, the study was conducted with 60 patients with physical status ASA I and II, aged 18 to 50 years of both sexes, who underwent elective below elbow surgeries under supraclavicular brachial plexus block. The patients were randomly allocated into 2 groups, A or B by a computer-generated random selection. Group A patients received supraclavicular brachial plexus block with 30 ml 0.5% ropivacaine and 1 ml (4mg) dexamethasone perineurally and 1ml 0.9% normal saline intravenously. Group B patients received supraclavicular brachial plexus block with 30 ml 0.5% ropivacaine and 1 ml 0.9% normal saline perineurally and 1ml (4mg) dexamethasone intravenously. The onset of sensory and motor block was evaluated every 3 minutes up to 30 minutes after injection of local anaesthetic. Sensory block was assessed by a pin prick test in the median, radial, ulnar, and musculocutaneous nerve distributions using a 3-point scale [3]: 0-normal sensation 1-loss of sensation to pin prick 2-loss of sensation to light touch. Motor block was evaluated by Modified Bromage Scale (MBS) for upper limb: [3] Grade 0: Normal motor function with full flexion and extension of the elbow, wrist, and fingers. Grade 1: Decreased motor strength with the ability to move fingers and/or wrists only. Grade 2 -Complete motor blockade with inability to move fingers.

Successful block is defined as complete absence of sensation in all the dermatomes in the operated extremity with no power to move elbow and wrist joints, evaluated at 30 minutes after block administration.[4]

Onset of sensory blockade is considered as the time interval between the end of local anaesthetic administration and loss of sensation to pin prick. Onset of motor blockade is considered as the time interval between the end of local anaesthetic administration and paresis (motor grade-1).[5] During post operative period analgesia and motor blockade was assessed by VAS (i.e. Visual Analogue Scale; VAS 0 – no pain, VAS 10 – worst pain imaginable). Inj tramadol (1 mg/kg) intramuscularly was used as a rescue analgesic, when the VAS score was more than 4 or on the patient's demand. The time for demanding rescue analgesia was noted by the attending nurse.

Statistical Analysis: The primary aim of this study was to determine the duration of analgesia, defined as the time from the injection of the drug to the patient's first request for a rescue analgesic. [6] Based on a previous study conducted by Godbole MR et al.7, considering the mean (standard deviation) duration of analgesia of 948 ± 156 minutes, to detect a difference of 121 minutes in the time for first rescue analgesia, 26 samples were required in each group with a power of 80% at the significance level of 0.05. Considering an attrition rate of 15%, 30 patients were allocated to each group. Statistical analysis was performed using SPSS version 21.

Results:

Table 1: Demographic data and duration of surgery

Parameters	Group A (N=30)	Group B (N=30)	P Value
Average age, years	29.47 (9.49)	31.90 (9.81)	0.333
Sex (M/F)	23/7	19/11	0.26
ASA I/ ASA II	14/16	15/15	0.796
Body weight, kg	60.53 ± 5.81	60.77 ± 6.70	0.886
Height, cm	163.30 ± 5.22	162.77 ± 7.22	0.74
Duration of surgery, min	91.67 ± 15.61	91.17 ± 15.01	0.9

Table 1: Patients of comparable height, body weight, and ASA status were taken in both groups. There were more male patients compared to female patients.

Table 2:

Parameters	Group A	Group B	P Value
Sensory block onset time, min	9.83 ± 1.39	12.27 ± 1.78	**<0.001**
Motor block onset time, min	14.87 ± 1.43	16.93 ± 1.78	**<0.001**
Duration of analgesia, min	874.87 ± 41.09	615.17 ± 39.69	**<0.001**
Motor block duration, min	516.83± 26.24	473.33 ± 24.51	**<0.001**
Mean of total inj. Tramadol consumption (in mg) in 24 hrs	86.7±31.60	151.4±32.66	**<0.001**

Table 2: The onset of sensory and motor block was faster in patients receiving perineural dexamethasone [9.83 ± 1.39 min and 14.87 ± 1.43 min], respectively, compared to intravenous dexamethasone [12.27 ± 1.78 min and 16.93 ± 1.78 min] in supraclavicular brachial plexus block. The duration of analgesia was significantly prolonged in the perineural dexamethasone group (874.87 ± 41.09) min of group A compared to the intravenous dexamethasone group (615.17 ± 39.69) min of group B with a p value of 0.001. The duration of motor block was also significantly prolonged in the perineural dexamethasone group (516.83 ± 26.24) min of group A compared to the intravenous dexamethasone group (473.33 ± 24.51) min of group B with a p value of 0.001. The average consumption of analgesic (Inj. Tramadol-1 mg/kg) in the post-operative period up to 24 hours in group A was 86.7 ± 31.60 mg, and that in group B was 151.4 ± 32.66 mg.

Discussion:

The study was conducted on elective below-the-elbow surgeries under supraclavicular brachial plexus block. Group A patients received supraclavicular brachial plexus block with ropivacaine and dexamethasone. Group B patients received supraclavicular brachial plexus block with ropivacaine and normal saline perineurally and dexamethasone intravenously. Purpose observe how significantly perineural dexamethasone can reduce the total analgesic requirement and delay the first request for rescue analgesia.

In the present study, the onset of sensory block in group A was 9.83 ± 1.39 minutes, and in group B it was 12.27 ± 1.78 minutes. The onset of motor block in group A was 14.87 ± 1.43 minutes, and in group B it was 16.93 ±1.78 minutes.

Onset of both sensory and motor block sets occurs significantly earlier in group A compared to group B. The findings of the

present study were consistent with those of Mathew R et al.[8] where both sensory and motor onset were significantly faster in patients receiving perineural dexamethasone compared to without perineural dexamethasone group (sensory block onset times of 10.2±1.44 min and 11.60 ±1.44 min, and motor block onset times of 13.92± 1.75 min and 14.96 ±1.27 min, in group A and group B, respectively). Dar FA et al. [6] also evaluated the sensory and motor block onset times and found them to be earlier in patients receiving dexamethasone as compared to the control group. But Godbole MR et al. [7] found no significant difference in the time of onset of sensory and motor block in the perineural dexamethasone group compared to the intravenous dexamethasone group. This could be because they used 0.05 mg/kg of dexamethasone, whereas the current study used 4 mg of dexamethasone.

In the present study, the duration of the motor block in group A (516.83 ± 26.24 minutes) was significantly prolonged compared to group B (473.33± 24.51 minutes). Godbole et al.[7] and Aliste J et al.[9] both found the duration of motor blockade significantly prolonged in patients receiving perineural dexamethasone compared to without dexamethasone (12.67 ± 2.11 hours and 7.17 ±0.95 hours, respectively) and (17.5 hours and 12.8 hours, respectively). The duration of motor block was longer in both study groups compared to the present study, which might be because of the higher dose of dexamethasone (8 mg) and with bupivacaine. Dar FA et al. [6] also found a similar result.

In the present study, the mean time taken for the first request for rescue analgesia in group A was 874.87 ± 41.09 minutes, while in group B it was 615.17 ± 39.69 minutes. That is, the duration of analgesia in Group A (group receiving ropivacaine with perineural dexamethasone) was significantly delayed by almost 4 hours as compared to Group B (group receiving ropivacaine with intravenous dexamethasone). It is consistent with the findings of Godbole MR et al.[7] who also found that the time required for the first request of analgesia in group BD (perineural dexamethasone) was 15 ± 2.6 hours as against 10.3 ± 1.07 hours in group BI (intravenous dexamethasone), P 0.001. In the present study, a fixed dose of 4 mg of dexamethasone was used, whether intravenously or perineurally, in all the patients, but Godbole MR et al. [7] used dexamethasone at a dose of 0.05 mg/kg in the said routes.

Kawanishi R et al. [10] used dexamethasone (4 mg) in an interscalene brachial plexus block (IBPB) with ropivacaine 0.75% (20 ml). They found that the median time for first rescue analgesia in the group receiving perineural dexamethasone was 18 hours, and, in the group, receiving intravenous dexamethasone was 14 hours, compared to 11.2 hours in the control group. The duration was more prolonged compared to the present study; this might be attributed to the fact that the authors had used ropivacaine 0.75% as compared to the present study where concentration of 0.5% was used.

Aliste et al. [9] compared the effects of intravenous and perineural dexamethasone (8 mg) in patients undergoing upper limb surgery under ultrasound (US)-guided axillary brachial plexus block with 30 ml of 0.25% bupivacaine. The duration of analgesia in the perineural dexamethasone group was found to be 21.1 hours, compared to 17.1 hours in the intravenous dexamethasone group. The difference being statistically significant ($p < 0.001$). The longer duration of analgesia in both their study groups compared to the present study might be because they used a higher dose of dexamethasone (8 mg) with bupivacaine. Bupivacaine has been found to be more potent than ropivacaine. [11] Also, the use of ultrasound in providing regional anaesthesia has proven to be superior when

compared to peripheral nerve stimulation. Rosenfeld DM et al. [12] compared the effects of perineural dexamethasone (8 mg) and intravenous dexamethasone (8 mg) with a control group in patients receiving an interscalene brachial plexus block with ropivacaine 0.5% for shoulder surgery. The duration of analgesia in both their study groups was longer compared to the present study. This might be attributed to the fact that they used a higher dose of 8 mg of dexamethasone whereas the present study used a dose of 4 mg.

The rescue analgesia used in our study was inj tramadol (1 mg/kg) administered intramuscularly. Analgesic was given whenever the patient demanded, or the VAS score was 4. The average analgesic consumption (inj. tramadol) in the post-operative period up to 24 hours in group A was 86.7 ± 31.60 mg and that in group B was 151.40 ± 32.66 mg, which was significantly lower in group A (p 0.001). The patients receiving perineural dexamethasone demanded inj tramadol fewer number of times in 24 hour post operative period as compared to the patients receiving intravenous dexamethasone in supraclavicular brachial plexus block. De Oliveira GS et al. [13] did a meta-analysis of four studies to observe the postoperative morphine consumption in patients receiving perineural dexamethasone. Like the present study, they observed a significantly lower postoperative analgesic consumption when compared to the control group. Abdallah FW et al. and Rosenfeld DM et al. [12] found that the average postoperative analgesic consumption (morphine) in the perineural group was less than the intravenous group (12.2 mg and 17.1 mg, respectively). Although both the perineural and intravenous dexamethasone groups consumed a lesser amount of analgesics than the control group, there was no significant difference between the two groups when compared to each other. It was in contrast to the present study, as pain perception varies from person to person according to age, lifestyle, etc., and the type of operation chosen. The incidence of adverse effects in both groups of our study was low. Bradycardia was observed in only 1 patient in group B, and it was not seen in group A. Hypotension was observed in 1 patient in group A and in 1 patient in group B. Nausea and vomiting were observed in 1 patient in group A and 1 patient in group B. Other complications like local anaesthetic systemic toxicity, respiratory depression, sedation, etc. were not observed in our study population. The incidence of adverse effects that occurred in both groups was not statistically significant.

Conclusions:

From the present study, it has been concluded that perineural dexamethasone as an adjunct to ropivacaine in supraclavicular brachial plexus block not only enhances the onset of sensory and motor block but also prolongs the duration of motor block. It significantly delays the time of the first request for rescue analgesia and decreases the total postoperative analgesic requirement.

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