

Original Research Article

Assessment of duration of analgesia after supraclavicular brachial plexus block using bupivacaine with and without intravenous dexamethasone: A comparative observational study

Running title : Duration of analgesia after supraclavicular brachial plexus block using bupivacain with and without IV dexamethasone.

ABSTRACT

Aim: To compare and analyze the duration of analgesia after giving supraclavicular block using bupivacaine with and without intravenous dexamethasone.

Methodology: The study was done in a tertiary care teaching hospital over 06 months. All eligible 50 patients were divided into two groups of 25 each. Group A patients receiving block by 40 ml of 0.25% bupivacaine were compared with Group B patients receiving 40 ml of 0.25% bupivacaine along with 8 mg intravenous dexamethasone. Duration of analgesia was calculated from the time of pain relief after block to the appearance of pain or Numerical Scale Rating (NRS) more than four. Any other complications were also noted. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 21, IBM Inc. As the data was found to be normally distributed bivariate analyses were performed using an independent t-test.

Result: Mean duration of analgesia was found to be significantly more among subjects given

Analgesia with bupivacaine and iv dexamethasone as compared to subjects given Analgesia with bupivacaine only as $p < 0.05$. No significant difference was seen in the distribution of complications like nausea and vomiting among the two study group when compared using Chi-square test as $p > 0.05$.

Conclusion: In conclusion, the addition of dexamethasone supraclavicular brachial plexus block provides prolongation of the duration of the block and decreases the incidence of postoperative nausea and vomiting that may have a great impact on patient comfort.

Keywords : Supraclavicular brachial plexus block, bupivacaine, intravenous dexamethasone, nausea, vomiting

INTRODUCTION

The anterior rami of C5 to T1 form the brachial plexus, which exits the cervical spine to form the superior, middle, and inferior trunks that travel between the anterior and middle scalene muscles. Each trunk divides into an anterior and posterior branch, which subsequently rejoins to form the lateral, posterior, and medial cords as it travels distally to the clavicle. The supraclavicular approach blocks the brachial plexus from the distal trunks to the proximal cords but often is targeted at the divisions level.¹ Supraclavicular brachial plexus block is a regional anesthesia technique that is sometimes employed as an alternative or as an adjunct to general anesthesia for surgery of the upper extremity. This technique involves the injection of local anesthetic agents close to the brachial plexus, temporarily blocking the sensation and ability to move the upper extremity. First introduced in 1911 by Kulenkampff as a landmark-based approach, the associated risk of pneumothorax was likely responsible for the technique falling out of favor.² With the advent of ultrasonography, La Grange described the utilization of the Doppler probe to identify arteries in 1978.³ Contemporarily, Kapral and colleagues advocated for the dynamic use of ultrasound to guide needle advancement in the supraclavicular position.⁴

Dexamethasone is a glucocorticosteroid with anti-inflammatory properties that are enjoying more widespread use by anesthesiologists as a systemic, epidural, or perineural analgesic adjunct. It appears that dexamethasone is able to act synergistically with local anesthetics to achieve better quality and duration of analgesia, limiting the need for alternative analgesics – particularly opioids.⁵⁻⁶ Intravenous dexamethasone is also useful in attenuating the postoperative need for analgesics in different clinical settings even in the absence of any nerve blocks.⁷ Hence, it is logical to compare the duration of analgesia with the use of iv dexamethasone in the setting of supraclavicular brachial plexus block.

MATERIALS AND METHODS

A prospective, comparative observational study was conducted in a tertiary care teaching hospital during a period of 06 months. The study is conducted and reported according to STROBE guidelines. The sample size was calculated using G power software v 3.1. After obtaining approval from the ethical committee of the institution and written informed consent, a total of 50 eligible patients are divided into two groups of 25 each. All included patients were in the age group 18-60 years, both genders, American society of anesthesiologist classification I and II, and patients requiring upper limb surgeries. Patients who refused to participate, with coagulopathies, or under American society of anesthesiologist classification III and more, or with an allergy to local anesthetics were excluded.

Twenty-five patients undergoing upper limb surgeries who receives 40 ml of 0.25% bupivacaine (group A) were compared with patients receiving 40 ml of 0.25% bupivacaine (group B) along with 8 mg intravenous dexamethasone.⁶ Dexamethasone was given just after the block. Reason of choosing 0.25% bupivacaine was 1) We needed to provide only sensory block which could be achieved with this concentration. 2) by considering low concentration larger volume of drug can be infiltrated to extend its duration. All the blocks were given under ultrasound guidance. Patients familiarized with Numerical Scale Rating(NRS) before giving block. A study was done to analyze the duration of analgesia after supraclavicular block which is calculated from the time of pain relief after block to appearance of pain or Numerical Scale Rating (NRS) more than four. Post-operative complications like nausea and vomiting were also noted.

STATISTICAL ANALYSIS

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 21, IBM Inc. Descriptive data were reported for each variable. Descriptive statistics such as mean and standard deviation for continuous variables were calculated. As the data was found to be normally distributed bivariate analyses were performed using an independent t test. Comparison of categorical variables between two study groups was done using Chi square test, Level of statistical significance was set at a p-value less than 0.05 and was denoted as *.

RESULTS

The present study was conducted among total of 50 subjects i.e 25 in each study group.

Distribution of study subjects did not differ significantly in terms of age and gender (table 1).

The mean duration of analgesia was found to be 12.20 ± 2.19 hours among subjects given subjects given Analgesia with bupivacaine only and it was found to be 20.52 ± 2.63 hours among subjects given Analgesia with bupivacaine and iv dexamethasone. An independent t test was applied to assess the level of significance. The mean duration of analgesia was found to be significantly more among subjects given Analgesia with bupivacaine and iv dexamethasone as compared to subjects given Analgesia with bupivacaine only as $p < 0.05$ (Table 2). No significant difference was seen in the distribution of complications like nausea and vomiting among the two study group when compared using Chi-square test as $p > 0.05$ (Table 3).

Table 1: Demographic details of study participants

| | Analgesia with bupivacaine | Analgesia with bupivacaine and iv dexamethasone |
|---------------|----------------------------|---|
| N | 25 | 25 |
| Males N (%) | 19 (76%) | 17 (68%) |
| Females N (%) | 6 (24%) | 8 (32%) |
| P value | 0.765 | |

Table 2: Comparison of mean duration (hours) of analgesia between two study groups

| | Grp | N | Mean | Std. Deviation | Std. Error Mean | Median | OUR | t | P value |
|------|-----------|---|------|----------------|-----------------|--------|-----|--------|---------|
| Time | Analgesia | 2 | 12. | 2.19 | .439 | 12 | 4 | -12.31 | <0.000 |

| | | | | | | | | | |
|-------------|--|---|-----|------|------|----|---|--|----|
| in Hours | with bupivacain e | 5 | 20 | | 7 | | | | 1* |
| | Analgesia with bupivacain e and iv dexametha sone | 2 | 20. | 2.63 | .526 | 22 | 4 | | |
| | | 5 | 52 | | 4 | | | | |

Table 3: Comparison of complications occurring between two study group

| | | Nausea and vomiting | | Total | Chi square value | P value |
|-------|---|---------------------|-----|-------|------------------|---------|
| | | No | Yes | | | |
| Group | Analgesia with bupivacaine | 21 | 4 | 25 | 4.348 | 0.055 |
| | Analgesia with bupivacaine and iv dexamethasone | 25 | 0 | 25 | | |
| Total | | 46 | 4 | 50 | | |

DISCUSSION

Blocking the brachial plexus is a simple and relatively safe procedure for upper limb surgery. The combination of lignocaine and bupivacaine provides good surgical conditions, but analgesia rarely lasts more than 34 hours. Dexamethasone is a synthetic adrenergic corticosteroid with anti-inflammatory and analgesic properties and is known as a local anesthetic adjuvant for prolonging analgesia. Dexamethasone microspheres have been shown to prolong the duration of bupivacaine intercostal nerve block in animals and humans. Dexamethasone has also been shown to prolong the duration of lidocaine axillary block and intravenous local anesthesia (IVRA).^{7,8,9,10} Hence prospective, comparative observational study was conducted to observe and compare the duration of analgesia after supraclavicular brachial plexus block using bupivacaine with and without intravenous dexamethasone.

Corticosteroids cause some vasoconstrictions, which are probably mediated by classical glucocorticoid receptor occupancy rather than non-specific pharmacological mechanisms. Regarding the dose of dexamethasone for the prevention of postoperative nausea and vomiting, a dose of 4 to 5 mg seems to be generally accepted. The dose of dexamethasone required for analgesia appears to be slightly higher than the dose used to prevent postoperative nausea.^{11,12,13}

Results of the present study showed that duration of analgesia significantly increased when given synergistically with dexamethasone. Also, complication like nausea and vomiting occurred less with dexamethasone injection. Similar results were obtained by Tandoc et al,¹⁴ Cummings et al¹⁵, Meitei et al¹⁶ and Parrington et al¹⁷ who investigated the duration of analgesia with a bupivacaine and dexamethasone mixture with an interscalene blockade. Observations of the study were also comparable with the studies conducted by Golwala MP et al¹⁸ and Islam SM et al.

Dissimilar observations were reported by Movafegh A et al²⁰ where no significant difference was seen in the two study groups i. e with or without dexamethasone. This difference could be possibly due to different local anesthetics used and their lower concentration. However duration of sensory block was significantly longer in dexamethasone group compared to control group. Hence the addition of dexamethasone to the local anesthetics for supraclavicular brachial plexus block results in significantly early onset of sensory block and markedly prolonged duration of analgesia.

No study comes without limitation. A possible limitation of the present study was shorter follow up duration. However, although it is possible for patients to report side effects that may simulate delayed neuropathy, continuous follow-up with questionnaires and long-term regular follow-up for future investigations. It is advisable to establish.

CONCLUSION

In summary, addition of intravenous dexamethasone to blockade of the supra clavicular brachial plexus prolongs the duration of analgesia and reduces the incidence of postoperative nausea and vomiting. This can have a significant impact on patient comfort.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

References

1. Brown DL, Cahill DR, Bridenbaugh LD. Supraclavicular nerve block: anatomic analysis of a method to prevent pneumothorax. *Anesth Analg*. 1993 Mar;76(3):530-4. PubMed
2. Kulenkampff D. Brachial plexus anaesthesia: its indications, technique, and dangers. *Ann Surg*. 1928 Jun;87(6):883-91. PMC free article PubMed
3. la Grange P, Foster PA, Pretorius LK. Application of the Doppler ultrasound bloodflow detector in supraclavicular brachial plexus block. *Br J Anaesth*. 1978 Sep;50(9):965-7.
4. Kapral S, Krafft P, Eibenberger K, Fitzgerald R, Gosch M, Weinstabl C. Ultrasound-guided supraclavicular approach for regional anesthesia of the brachial plexus. *Anesth Analg*. 1994 Mar;78(3):507-13. PubMed
5. Waldron NH, Jones CA, Gan TJ, et al. Impact of perioperative dexamethasone on postoperative analgesia and side-effects: systematic review and meta-analysis. *Br J Anaesth*. 2013;110(2):191–200.10.1093/bja/aes431 Crossref, PubMed, Web of Science®, Google Scholar
6. Choi S, Rodseth R, McCartney CJ. Effects of dexamethasone as a local anaesthetic adjuvant for brachial plexus block: a systematic review and meta-analysis of randomized trials. *Br J Anaesth*. 2014 Mar;112(3):427–39.10.1093/bja/aet417 Crossref, PubMed, Web of Science®, Google Scholar
7. De Oliveira GS Jr., Almeida MD, Benzon HT, McCarthy RJ. Perioperative single dose systemic dexamethasone for postoperative pain: A meta-analysis of randomized controlled trials. *Anesthesiology* 2011;115:575-88.
8. Dräger C, Benziger D, Gao F, Berde CB. Prolonged intercostal nerve blockade in sheep

using controlled-release of bupivacaine and dexamethasone from polymer microspheres. *Anesthesiology* 1998; 89:969–979.

9. Estebe JP, Le Corre P, Clément R, et al. Effect of dexamethasone on motor brachial plexus block with bupivacaine and with bupivacaine-loaded microspheres in a sheep model. *Eur J Anaesthesiol* 2003; 20:305–310.
10. Kopacz DJ, Lacouture PG, Wu D, et al. The dose response and effects of dexamethasone on bupivacaine microcapsules for intercostal blockade (T9 to T11) in healthy volunteers. *Anesth Analg* 2003; 96:576–582.
11. Holte K, Werner MU, Lacouture PG, Kehlet H. Dexamethasone prolongs local analgesia after subcutaneous infiltration of bupivacaine microcapsules in human volunteers. *Anesthesiology* 2002; 96:1331–1335.
12. Marks R, Barlow JW, Funder JW. Steroid-induced vasoconstriction: glucocorticoid antagonist studies. *J Clin Endocrinol Metab* 1982; 54:1075–1077.
13. Seidenari S, Di Nardo A, Mantovani L, Giannetti A. Parallel intraindividual evaluation of the vasoconstrictory action and the antiallergic activity of topical corticosteroids. *Exp Dermatol* 1997; 6:75–80.
14. Tandoc MN, Fan L, Kolesnikov S, Kruglov A, Nader ND. Adjuvant dexamethasone with bupivacaine prolongs the duration of interscalene block: a prospective randomized trial. *J Anesth* 2011; 25: 704–9
15. Cummings KC III, Napierkowski DE, Parra-Sanchez I, et al. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. *Br J Anaesth* 2011; 107: 446–53
16. Meitei AJ, Ningombam T, Singh TH, Rajkumar G, Devi NA, Singh YA. A

comparative study of ropivacaine versus ropivacaine plus dexmedetomidine under epidural anesthesia in lower limb surgeries. *Journal of Medical Society*.M2019;33:20-27

17. Parrington SJ, O'Donnell D, Chan VW, Brown-Shreves D, Subramanyam R, Qu M, et al. Dexamethasone added to mepivacaine prolongs the duration of analgesia after supraclavicular brachial plexus blockade. *Reg Anesth Pain Med*. 2010;35:422–6.
18. Golwala MP, Swadia VN, Dhimar AA, Sridhar NV. Pain relief by dexamethasone as an adjunct to local anaesthetics in supraclavicular brachial plexus block. *J Anaesthesiol Clin Pharmacol*. 2009; 25(3): 285–8
19. Islam SM , Hosain MHMD, Maruf AA . Effect of addition of dexamethasone to local anesthetics supraclavicular brachial plexus block. *JAFMC*. 2011;7(1)11-14.
20. Movafegh A, Razazian M, Hajimaohamadi F, et al. Dexa- methasone added to lidocaine prolongs axillary brachial plexus blockade. *Anesth Analg*. 2006;102:263-267