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Original Research Article

Comparison of Tramadol and Dexamethasone as an Adjuvant to Bupivacaine in Supraclavicular Brachial Plexus Block

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Abstract:

Background and Aim: A list of supraclavicular block additions is available to help with the onset, severity, and duration of the block. These additives may also be wise for postoperative analgesia. In this study, we compared the effectiveness of tramadol and dexamethasone when combined with bupivacaine to block the supraclavicular brachial plexus in terms of the timing of the onset of sensory and motor blockade, the length of the sensory and motor blockade, haemodynamic factors, and the elapsed time before the first rescue analgesia in the first 24 hours following surgery.

Material and Methods: 150 patients in ASA grades I and II, between the ages of 18 and 65, scheduled for upper limb orthopaedic procedures with supraclavicular brachial plexus blocks were divided into three groups of 50 patients each after receiving approval from the institutional ethical committee. Group I received 100 mg of tramadol (50 mg/ml) and 28 ml of 0.5% bupivacaine. 28 ml of 0.5% bupivacaine and 8 mg of dexamethasone (4 mg/ml) were given to group II. Group III received 2 ml of normal saline and 28 ml of 0.5% bupivacaine. It was observed when the sensory and motor block began and how long it lasted. From the time of baseline until the first rescue analgesic was used, hemodynamic variables were monitored.

Results: In the current investigation, Group II (8.94 ± 1.58 min) experienced sensory onset time that was substantially sooner than that of Groups I (12.03 ± 2.40 min) and III (18.85 ± 4.48 min). In comparison to Group I (23.10 ± 3.56 min) and Group III (26.95 ± 3.67 min), Group II's time of motor initiation was much earlier (14.48 ± 2.48 min). Maximum sensory block time was experienced by Group II patients (424.58 ± 41.98 minutes), followed by Group I (380.65± 59.47 minutes), and minimal sensory block time was experienced by Group III patients (301.39±53.69 min).

Conclusion: The results of this study demonstrated that, of the two combinations, Dexamethasone was more efficient than Tramadol in the specified drug dose combination. It is also advised to do more research using other drug-dose combinations in order to confirm the results of the current study and establish the ideal and most efficient dose of adjuvants and local anaesthetic.

Keywords: Bupivacaine, Dexamethasone, Supraclavicular block, Tramadol.

Introduction

The brachial plexus block is specifically designed for procedures on the upper limbs. Unwanted problems resulting from the administration of various medicines during general anaesthesia and during the process of upper airway instrumentation are avoided by brachial plexus block. There are several ways to block the brachial plexus, but the supraclavicular technique is the most popular because of how closely the nerve trunks are packed together. Since it allows the clinician to place the local anesthetic close to the nerves in real time and is typically free of complications, using ultrasound to administer a supraclavicular block has become the gold standard. Patients with serious co-morbidities, such as severe respiratory and cardiovascular conditions, morbid obesity, and those who may have airway issues, can benefit greatly from it. To do a Brachial Plexus block, adequate knowledge of the Brachial Plexus' anatomy is required. The entire upper limb is blocked proximally up to mid-arm level using the supraclavicular method. Due to its prolonged duration of action and good ratio of sensory to motor neural block, bupivacaine is typically the

medication of choice. Adjuvants are included to increase the effectiveness and duration of analgesia while reducing the amount of local anaesthetic required. To enhance the effectiveness of nerve blocks, adjuvants such dexamethasone and tramadol are given to local anaesthetics. Analgesic tramadol has both opioid and nonopioid action. Due to its lipophilic nature, tramadol appears to pass through the neuronal membrane and disperse into the interstitial or axonal fluid.[1] Alpha 2 agonists and the inhibition of serotonin and noradrenaline absorption in the central nervous system are the mechanisms used for the nonopioid activity. It is thought to enhance the effects of local anaesthetics when combined with other drugs because it prevents norepinephrine and serotonin from the nerve endings from being reabsorbed.[2-5] Vasoconstriction brought on by steroids reduces the absorption of topical anaesthetics.[6]A recent review stated that tramadol stimulated intrathecal serotonin release while blocking central norepinephrine reuptake.

Additionally, it inhibits voltage-gated sodium channels in vitro in a manner unrelated to opioid receptors and is a mild agonist of both the and opioid receptors. Steroids prolong the analgesic effect by inhibiting the production and release of different inflammatory mediators. [7-11] Dexamethasone increases the activity of inhibitory potassium channels on nociceptive C-fibers via acting on the glucocorticoid receptor, which lengthens the action of local anaesthesia.[12-15] It also functions as a mild agonist at both the mu and kappa opioid receptors and inhibits voltage-gated sodium channels in vitro in a manner unrelated to opioid receptor function. The duration of analgesia is extended by steroids because they prevent the synthesis and secretion of a number of inflammatory mediators. Dexamethasone prolongs the time that local anaesthesia lasts by acting on the glucocorticoid receptor, which raises the activity of inhibitory potassium channels on nociceptive C-fibers.

Material and Methods: Present 12-month prospective, interventional and randomized trial was carried out in a tertiary care facility. 150 patients in ASA grades I and II, between the ages of 18 and 65, scheduled for upper limb orthopaedic procedures with supraclavicular brachial plexus blocks were divided into three groups of 50 patients each after receiving approval from the institutional ethical committee. Group I received 100 mg of tramadol (50 mg/ml) and 28 ml of 0.5% bupivacaine. 28 ml of 0.5% bupivacaine and 8 mg of dexamethasone (4 mg/ml) were given to group II. Group III received 2 ml of normal saline and 28 ml of 0.5% bupivacaine.

Sensory block is graded as: 1. Grade 0: Sharp pin felt 2. Grade 1: Analgesia, dull sensation felt 3. Grade 2: Anaesthesia, no sensation felt Motor block was assessed by modified Bromage scale. 3

When the Visual Analogue Scale (VAS) score was more than 4, rescue analgesia in the form of an intramuscular injection of 75mg of diclofenac sodium was given. If any negative side effects existed, they were recognised, including nausea, vomiting, hypotension, bradycardia, and respiratory distress. The sample size was determined using the results of Shreshtha et al.[16].

Statistical analysis: The collected data was organised, inputted, and exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA) after being combined and entered into a spreadsheet programme (Microsoft Excel 2007). The level of significance and confidence level for each test were set at 5% and 95%, respectively.

Results: Age, gender, and body weight differences between patients in the aforementioned three groups were not determined to be statistically significant. Patients in all three groups were found to have similar heart rates, systolic blood pressure, diastolic blood pressure, and mean arterial pressure during all subsequent observational periods. ($p>0.05$) In the current investigation, Group II (8.94±1.58 min) experienced sensory onset time that was substantially sooner than that of Groups I (12.03±2.40 min) and III (18.85±4.48 min).(Table 1) All between-group differences were determined to be statistically significant, showing that Group II, Group I, and Group III had the earliest commencement of sensory perception. In comparison to Group I (23.10±3.56 min) and Group III (26.95±3.67 min), Group II's time of motor initiation was much earlier (14.48±2.48 min). (Table 1) The time of motor onset was determined to be Group II Group I Group III, with the difference between groups statistically significant. The highest mean length of sensory block was experienced by Group II patients (424.58±41.98 minutes), followed by Group I (380.65±59.47 minutes), and Group III (301.39±53.69 minutes). (Table 2)

Table 1: Intergroup comparison of time of sensory and motor onset among study population

Group	No	Mean	SD	P value
Time of Sensory onset				
Group I	50	12.03	2.40	0.03*
Group II	50	8.94	1.58	
Group III	50	18.85	4.48	
Time of Motor onset				
Group I	50	23.10	3.56	
Group II	50	14.48	2.48	0.05*
Group III	50	26.95	3.67	

* indicates statistically significance at p≤0.05

Table 2: Intergroup comparison of duration of sensory and motor block among study population

Group	No	Mean	SD	P value
Time of Sensory onset				
Group I	50	380.65	59.47	0.03*
Group II	50	424.58	41.98	
Group III	50	301.39	53.69	
Time of Motor onset				
Group I	50	325.22	46.89	
Group II	50	368.45	35.90	0.05*
Group III	50	275.36	67.22	

* indicates statistically significance at p≤0.05

Discussion

In procedures involving the upper limbs, the supraclavicular block is a frequently utilised regional nerve block. It consistently provides anaesthesia for treatments involving the entire upper limb. The brachial plexus division level is targeted, and a considerable volume of force is applied; the trunk level of the plexus may also be blocked. When administered as a single injection, the local anaesthetics that are currently on the market can only temporarily relieve pain. Plain bupivacaine improved working conditions, but it is uncommon for analgesia to last longer than 4 to 6 hours. Unsurprisingly, the anesthesiologist's top priority is to reduce suffering. Any postoperative pain management strategy must adhere to three fundamental standards. It must be efficient, secure, and feasible.

Numerous adjuvants to local anaesthetics have been researched in an effort to prolong the analgesia duration postoperatively, as was previously indicated. In a study by Shrestha et al.[16], the analgesic effectiveness of local anaesthesia with and without dexamethasone in supraclavicular brachial plexus block was compared. They came to the conclusion that using dexamethasone in addition to local anaesthetic greatly lengthens the duration of analgesia for brachial plexus block. Similarly, Movafegh et al[17] Parrington et al[18], Islam et al[13], Pathak et al[19], Kim et al[20], Dar et al[21], and Biradar et al[22], found that the addition of dexamethasone to various local anaesthetics significantly prolongs duration of sensory and motor block as well as duration of analgesia compared with only local anaesthetics when used for brachial plexus blockade in any form, i.e., interscalene, supraclavicular.

In the current investigation, Group II (8.94±1.58 min) experienced sensory onset time that was substantially sooner than that of Groups I (12.03±2.40 min) and III (18.85±4.48 min).(Table 1) All between-group differences were determined to be statistically significant, showing that Group II, Group I, and Group III had the earliest commencement of sensory perception. In comparison to Group I (23.10±3.56 min) and Group III (26.95±3.67 min), Group II's time of motor initiation was much earlier (14.48±2.48 min). (Table 1) The time of motor onset was determined to be Group II Group I Group III, with the difference between groups statistically significant. The highest mean length of sensory block was experienced by Group II patients (424.58±41.98 minutes), followed by Group I (380.65±59.47 minutes), and Group III (301.39±53.69 minutes). All between-group differences were statistically significant, showing that Group II had a longer sensory block than Group I and Group III. Maximum motor block time was experienced by Group II patients (368.45±35.90 minutes), followed by Group I (325.22±46.89 minutes), while the shortest motor block time was experienced by Group III patients. (275.36±67.22 min). The statistical significance of all between-group differences shows that Group II had a longer motor block than Group I and Group III. In a study by Kapral et al.[23] to determine the effect of tramadol combined with mepivacaine on the length of an axillary brachial plexus blockade, it was discovered that the tramadol group considerably lengthened the duration of the sensory

and motor block. Similar findings were made by Robaux et al.[24] and Chattopadhyay et al.[25], who discovered that the addition of tramadol significantly lengthens the duration of analgesia when compared to local anesthetic alone.

The duration of analgesia is efficiently and significantly extended by adding steroids to local anaesthetics. The anti-inflammatory and immunosuppressive effects of steroids are very strong. Dexamethasone is recommended because of its highly effective anti-inflammatory properties above other steroids because they have all been utilised for this purpose. It has a potency that is between 25 and 30 times greater than hydrocortisone and has no mineralocorticoid action. Thus was discovered to be risk-free and without any negative side effects. It is also known that dexamethasone lessens postoperative nausea and vomiting.

The dexamethasone impact may be connected to the local effect that corticosteroids may have on the nerve. Previous studies have shown that short-term (24-hour) use of dexamethasone is safe, and adverse effects with a single dosage of dexamethasone are likely to be incredibly rare and modest in character.[26,27] The onset and duration of motor blockage are improved with the addition of tramadol to local anesthetic drugs. The effects of the block are amplified by tramadol's special mechanism, which also likely has local anaesthetic effects and inhibits serotonin reuptake by nerve endings.

The brachial plexus block is a frequent method of providing analgesia and anaesthesia for procedures on the upper extremity. It is a viable substitute for general anaesthesia and a helpful supplement. Compared to general anaesthesia, this method increases patient satisfaction and causes less cognitive impairment. Several methods, including the implantation of continuous catheters and the administration of adjuvant medications, are employed to extend the analgesic effect of Brachial Plexus block. Epinephrine, clonidine, opioids, ketamine, and midazolam are a few adjuvants that have had mixed results. With respect to their rankorder anti-inflammatory potency, glucocorticoids have been demonstrated to extend nerve blockade more than corticosteroids do; this effect can be lessened by the corticosteroid antagonist Cortexolone.[28]

All three groups were statistically matched. All three groups in the current study experienced steady and comparable hemodynamics over the course of the investigation. In terms of sensory block ratings, they were consistently higher in the Tramadol and Dexamethasone groups compared to the Control group from intervals of 5 to 30 minutes and 240 to 480 minutes, respectively.

Comparing the sensory block scores between the two study groups revealed that Dexamethasone group scores were significantly higher than Tramadol group scores at intervals of 10 minutes, 15 minutes, and from 300 to 420 minutes, indicating that Dexamethasone group sensory block quality was superior to Tramadol group for the majority of the study duration. In terms of onset time, the Control group had the longest mean time taken for the start of sensory block, followed by the Tramadol group (11.94+2.59min). As a result, it can be shown that the Dexamethasone group's onset time was shortened by 2.94 minutes compared to the Tramadol group and by 10 minutes compared to the Control group. Contrarily, the onset time was shortened by 7.06 minutes in the Tramadol group as compared to the Control group.

Contrarily, the length of the sensory blockage was maximal in the Dexamethasone group and smallest in the Control group, thus highlighting that Dexamethasone increased the block duration by 125.71 and 44.57 minutes, respectively, as compared to the control and Tramadol groups. When Dexamethasone was combined with Bupivacaine in a supraclavicular brachial plexus block, Shaikh et al.[10] did not observe any appreciable changes in the onset time of the sensory block. However, similar to our study, they discovered that the Dexamethasone group's sensory block lasted longer than the control groups.

In studies comparing the effects of dexamethasone and tramadol, it was discovered that the onset time of the motor block was significantly slower with dexamethasone than with tramadol, and it was longest in the control group. The mean duration of the motor block was also significantly longer with dexamethasone than with tramadol, and it was shortest in the control group.

Nearly all of the researchers who compared them in different drug-dose combinations agreed with these findings. According to Shrestha et al.[11], there was a substantial difference between the two groups in terms of the length of the motor block, with the mean timings for the onset and duration of the motor block in the Tramadol group being 13.93 and 202.93 minutes, respectively, and 12.90 and 393.03 minutes in the Dexamethasone group. In their study, Shah et al.[18] reported the mean motor block onset and duration times as 13.07 and 356.1 minutes in the Tramadol group and 12.93 and 513.17 minutes in the Dexamethasone groups. They also discovered that the difference was significant for block duration alone. In each of these experiments, 2 ml/kg of 0.5% Bupivacaine was employed. However, we discovered that the difference was substantial for both the onset time and length of the block in the current investigation

since we utilised a fixed dose of 28 ml of 0.5% Bupivacaine.

In the current study, none of the patients in any of the three groups experienced any possible side effects, such as nausea, vomiting, headaches, or shivering. No mention of these adverse effects was mentioned in any of the other papers that we analysed, proving that both medications were nearly side effect free at the recommended dosages. Dexamethasone is also economical since it prolongs analgesia, which lessens the need for further analgesics.

Conclusion

The results of this study demonstrated that, of the two combinations, Dexamethasone was more efficient than Tramadol in the specified drug dose combination. It is also advised to do more research using other drug-dose combinations in order to confirm the results of the current study and establish the ideal and most efficient dose of adjuvants and local anaesthetic. Additionally, none of the drug's main adverse effects are present.

References

1. Alemanno F, Ghisi D, Fanelli A, Faliva A, Pergolotti B, Bizzarri F, et al. Tramadol and 0.5% levobupivacaine for single-shot interscalene block: Effects on postoperative analgesia in patients undergoing shoulder arthroplasty. Minerva Anestesiol. 2012;78: 291–6.
2. Kaabachi O, Ouezini R, Koubaa W, Ghrab B, Zargouni A, Ben Abdelaziz A. Tramadol as an adjuvant to lidocaine for axillary brachial plexus block. Anesth Analg. 2009;108: 367–70.
3. Nagpal V, Rana S, Singh J, Chaudhary SK. Comparative study of systemically and perineurally administered tramadol as an adjunct for supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2015; 31:191–5.
4. Yurtlu BS, Hanci V, Ege A, Bostankolu SE, Ayoglu G, Ozkocak Turan I. Tramadol as an adjunct for levobupivacaine in axillary plexus blockade: A prospective, randomized, double-blind study. Turk J Med Sci. 2012;42: 55–62.
5. Robaux S, Blunt C, Viel E, Cuvillon P, Nouguier P, Dautel G, et al. Tramadol added to 1.5% mepivacaine for axillary brachial plexus block improves postoperative analgesia dose-dependently. Anesth Analg. 2004; 98: 1172–7.
6. Cummings KC, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems JJ, et al. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth. 2011;107:m446–53.
7. Williams BA, Murinson BB, Grable BR, Orebaugh SL. Future consideration for pharmacology adjuvants in single-injection peripheral nerve blocks for patients with Diabetes Mellitus. Reg Anesth Pain Med. 2009; 34(5):445–57.
8. Biradar PA, Kaimar P, Gopalakrishna K. Effect of dexamethasone added to lidocaine in supraclavicular brachial plexus block: A prospective, randomised, double-blind study. Indian J Anaesth. 2013;57: 180–4.
9. Vieira PA, Pulai I, Tsao GC, Manikantan P, Keller B, Connelly NR. Dexamethasone with bupivacaine increases duration of analgesia in ultrasound-guided interscalene brachial plexus blockade. Eur J Anaesthesiol. 2010;27: 285–8.
10. Shaikh MR, Majumdar S, Das A, Saha TK, Bandyopadhyay SN, Mukherjee D, et al. Role of dexamethasone in supraclavicular brachial plexus block. J Dent Med Sci. 2013;12: 1–7. [Google Scholar]
11. Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular brachial plexus block with and without dexamethasone – A comparative study. Kathmandu Univ Med J (K UMJ) 2003; 1:158–60.
12. Trabelsi W, Lebbi A, Romdhani C, Naas I, Sammoud W. Dexamethasone provides longer analgesia than tramadol when added to lidocaine after ultrasound guided supraclavicular brachial plexus block. A randomized, controlled, double blinded study. Analg Resusc Curr Res. 2013;2: 1–6.
13. Islam SM, Hossain M, Maruf AA. Effect of addition of dexamethasone to local anaesthetics in supraclavicular brachial plexus block. J Armed Forces Med Coll Bangladesh. 2011; 7:11–4.
14. Persec J, Persec Z, Kopljar M, Zupcic M, Sakic L, Zrinjscak IK, et al. Low-dose dexamethasone with levobupivacaine improves analgesia after supraclavicular brachial plexus blockade. Int Orthop. 2014;38: 101–5.
15. 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;112: 427–39.
16. Shrestha BR, Maharjan SK, Shrestha S, Gautam B, Thapa C, Thapa PB, et al. Comparative study between Tramadol and Dexamethasone as an admixture to Bupivacaine in supraclavicular brachial plexus block. J Nepal Med Assoc. 2007; 46(168):158–64.
17. Movafegh A, Razazian M, Hajimaohamadi F, Meysamic A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. Anesth Analg 2006 Jan; 102(1):263-267.

18. Parrington SJ, O'Donnell D, Chan VW, Brown-Shreves D, Subramanyam R, Qu M, Brull R. Dexamethasone added to mepivacaine prolongs the duration of analgesia after supraclavicular brachial plexus blockade. Reg Anesth Pain Med 2010 Sep-Oct; 35(5):422-426.
19. Pathak RG, Satkar AP, Khade RM. Supraclavicular brachial plexus block with and without dexamethasone – a comparative study. IJSRP 2012 Dec;2(12):1-7.
20. Kim YJ, Lee GY, Kim DY, Kim CH, Baik HJ, Heo S. Dexamethasone added to levobupivacaine improves postoperative analgesia in ultrasound guided inter-scalene brachial plexus blockade for arthroscopic shoulder surgery. Korean J Anesthesiol 2012 Feb;62(2):130-134.
21. Dar FA, Najar MR, Jan N. Effect of addition of dexamethasone to ropivacaine in supraclavicular brachial plexus blockade. Indian J Pain 2013;27(3);165-169.
22. Biradar PA, Kaimar P, Gopalakrishna K. Effect of dexamethasone added to lidocaine in supraclavicular brachial plexus block: a prospective, randomised, double-blind study. Indian J Anaesth 2013 Mar;57(2):180-184.
23. Kapral S, Gollmann G, Waltl B, Likar R, Sladen RN, Weinstabl C, Lehofer F. Tramadol added to mepivacaine prolongs the duration of an axillary brachial plexus blockade. Anaesth Analg 1999 Apr;88(4):853-856.
24. Robaux S, Blunt C, Viel E, Cuvillon P, Nouguier P, Dautel G, Boileau S, Girard F, Bouaziz H. Tramadol added to 1.5% mepivacaine for axillary brachial plexus block improves postoperative analgesia. Anaesth Analg 2004 Apr;98(4):1172-1177.
25. Chattopadhyay S, Mitra LG, Biswas BN, Majumder P. Tramadol as an adjuvant for brachial plexus block. J Anaesth Clin Pharmacol 2007;23(2):187-189.
26. Fanelli G, Casati A, Magistris L, Berti M, Albertin A, Scarioni M, et al. Fentanyl does not improve the nerve block characteristics of axillary brachial plexus anesthesia performed with ropivacaine. Acta Anaesthesiol Scand. 2001;45(5):590–4.
27. Taluqdar M, Begum H, Shoman MM, Khatun UHS. Anaesthetic and Analgesic Effects of Adding Dexamethasone to Bupivacaine in Supraclavicular Brachial Plexus Block – A Comparative Study. J Bangladesh Coll Phys Surg. 2013; 31:11–7.
28. Castillo J, Curley J, Hotz J, Uezono M, Tigner J. Glucocorticoids prolong rat sciatic nerve blockade in vivo from Bupivacaine microspheres. Anesthesiology. 1996; 85(5): 1157–66.
29. Shah S, Shah B, Deb C. Comparison of Tramadol and Dexamethasone as an adjuvant to Bupivacaine in Supraclavicular brachial plexus block: A Randomised Comparative Study In Patients undergoing Elective Upper limb surgeries. Int J Intg Med Sci. 2016;3(6):321–6.