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Original Research Article

COMPARATIVE STUDY OF DEXAMETHASONE VS MIDAZOLAM AS AN ADJUNCT TO 0.5% BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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Abstract

Background: The supraclavicular brachial plexus block, enhanced by ultrasound guidance, provides superior analgesia, reduces opioid use, and minimizes complications. This study aimed to compare the efficacy of dexamethasone and midazolam, in addition to 0.5% bupivacaine, in upper limb surgeries performed under the ultrasound-guided supraclavicular approach of brachial plexus block. **Materials and Methods:** This randomized controlled study involved 60 patients undergoing elective upper limb surgeries at KAPV Govt Medical College and MGM Hospital, Trichy, from October 2021 to 2022. group A received 20 ml of 0.5% bupivacaine with 8 mg dexamethasone, while group B received 20 ml of 0.5% bupivacaine with 50 mg/kg midazolam. The study evaluated sensory and motor blockade onset, duration, analgesia length, hemodynamic parameters, and adverse effects across groups. **Result:** The onset of sensory and motor block was significantly faster in group A (sensory 8.90±0.96 min, motor 10.40±1.13 min) compared to group B (sensory 12.57±0.68 min, motor 13.80±0.71 min) ($p<0.0001$). The duration of sensory and motor block was significantly longer in group A (sensory 1144±22.98 min, motor 1124.67±21.77 min) compared to group B (sensory 752.33±16.54 min, motor 712.6±13.63 min) ($p<0.0001$). The mean duration of analgesia was significantly prolonged in group A (1199±60.76 min) compared to group B (806.33±17.90 min) ($p<0.0001$). The sedation score was significant high in group B (1.57±0.56) than in Group A (1.07±0.25) ($p<0.0001$). **Conclusion:** Dexamethasone added to 0.5% Bupivacaine in ultrasound-guided supraclavicular brachial plexus block accelerated onset, prolonged sensory and motor blockade duration, and extended analgesia time.

INTRODUCTION

The brachial plexus block for upper limb surgery provides superior analgesia and reduces opioid consumption. Supraclavicular brachial plexus block is a commonly performed anaesthetic technique for patients undergoing surgery on the upper limb. It blocks the plexus at the trunk level. Ultrasound-guided Supraclavicular brachial plexus block is a safe and reliable technique that provides decreased procedure time, faster onset, and higher block success rate and avoids complications such as inadvertent intravascular injection, pneumothorax, and nerve trauma. It also helps reduce the total volume of drug required to be injected to anesthetise the plexus, thereby decreasing the chances of systemic toxicity of local anaesthetics. Bupivacaine is a long-acting local anaesthetic commonly used in brachial plexus block, and the effect lasted for 3 to 6 hours.[1]

Adjuncts to local anaesthetics enhance the quality and duration of analgesia. Steroids have anti-inflammatory properties and improve analgesia by inhibiting the potassium channel-mediated discharge of nociceptive C fibres. It induces vasoconstriction, which decreases the local anaesthetic absorption.[2]

Midazolam is a short-acting, water-soluble benzodiazepine. It produces antinociception and potentiates the effects of local anaesthetics through its action on gamma-aminobutyric acid A (GABA-A) receptors, stimulating the influx of chloride ions and resulting in the inhibition of nerve impulse conduction due to membrane hyperpolarisation.[3]

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Aim

This study aimed to compare the efficacy of dexamethasone and midazolam, in addition to 0.5% bupivacaine, in upper limb surgeries performed under the ultrasound-guided supraclavicular approach of brachial plexus block.

MATERIALS AND METHODS

This prospective randomised interventional controlled study included 60 patients scheduled for elective upper limb surgeries in the Department of Anaesthesiology at KAPV Govt Medical College and MGM Hospital, Trichy, between October 2021 and 2022. This study was approved by the Institutional Ethics Committee before initiation (I.E.C.NO.012/2021), and informed consent was obtained from all patients.

Inclusion Criteria

Patients with ASA physical status 1-2, ages between 18-60 years, BMI 17-35 kg/m2, scheduled for elective upper limb surgeries were included.

Exclusion Criteria

Patients allergic to local anaesthetic agents, coagulation disorders, history of major psychiatric illness, respiratory compromise, chronic pain syndrome, diabetes, or pregnancy were excluded.

Methods

Thirty patients were randomly allocated to two groups. Group A (n=30): Thirty patients received ultrasound-guided supraclavicular brachial plexus block using 20 mL of 0.5% bupivacaine combined with 8 mg of dexamethasone. Group B (n=30): Thirty patients received ultrasound-guided supraclavicular brachial plexus block using 20 mL of 0.5% bupivacaine combined with midazolam at a dose of 50 mg/kg.

The materials and equipment required included sterile sponge-holding forceps, sterile trays, sterile swabs, and preservative-free medications, such as dexamethasone, bupivacaine, and midazolam. An ultrasound machine with a high-frequency linear probe is essential. Additionally, equipment and medications for resuscitation and conversion to general anaesthesia are readily available to manage potential block failures.

Patients were preoperatively assessed and ASA risk-stratified, with basic investigations including blood tests, chest radiography, and ECG. Thirty minutes before surgery, all patients received intravenous metoclopramide 10 mg and ranitidine 50 mg as premedication. A peripheral venous line was established using an 18G cannula, and crystalloid infusion was initiated. Baseline parameters including heart rate, blood pressure, SpO2, and respiratory rate were recorded. The study drugs were administered by complete blinding.

Patients were positioned with the ipsilateral arm abducted and the head turned away from the blocked side. Ultrasound-guided supraclavicular brachial plexus block was performed with the study medication. Sensory and motor blocks were assessed regularly until complete pain loss (grade 2) and limb paralysis (grade 3) occurred. Inadequate blocks were managed under general anaesthesia. The sedation score was measured using the Ramsay Sedation scale. Intraoperative monitoring included heart rate, blood pressure, respiratory rate, and sedation score, with adverse effects, such as bradycardia, treated with atropine. Surgery proceeded with appropriate block levels, and postoperative analgesia was provided with tramadol 50 mg IV.

The duration was measured from the complete loss of pinprick perception (grade 2) to the onset of pain requiring analgesia (grade 0) and from full motor paralysis (grade 3) to the return of motor function (grade 0). Additionally, the interval between the onset of the sensory block and the first need for analgesia was recorded.

Statistical Analysis

Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent-sample t-test. Categorical variables were compared using Pearson's chi-squared test. Significance was defined as P values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

There were no significant differences in age, weight, or duration of the procedure between the groups ($p = 0.778$, $p = 0.397$, $p = 0.111$, respectively). The commencement time of sensory block was significant in group A (8.9 ± 0.96 minutes) compared to group B (12.57 ± 0.68 minutes) ($p < 0.0001$). Additionally, the extent of the sensory block, commencement time, and extent of the motor block were significantly longer in group A than in group B ($p < 0.0001$). The extent of analgesia was also significant in group A (1199 ± 60.76 minutes) compared to that in group B (806.33 ± 17.90 min) ($p < 0.0001$) [Table 1].

Table 1: Comparison of demographic and clinical parameters between groups.

	Group A	Group B	P value
Age in year	38.93 ± 9.53	39.63 ± 9.63	0.778
Weight (kg)	59.24 ± 4.36	60.37 ± 3.98	0.397
Duration (minutes)	121.67 ± 26.11	135 ± 25	0.111
Commencement time of sensory block (minutes)	8.9 ± 0.96	12.57 ± 0.68	< 0.0001
Extent of sensory block (minutes)	1144 ± 22.98	752.33 ± 16.54	< 0.0001
Commencement time of motor block (minutes)	10.40 ± 1.13	1.13 ± 0.71	< 0.0001
Extent of the motor block (minutes)	1124.67 ± 21.77	712.67 ± 13.63	< 0.0001

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Extent of analgesia (minutes)	1199 ± 60.76	806.33 ± 17.90	< 0.0001

Table 2: Comparison of sex, ASA status, and adverse effects between groups

		Group A	Group B	P value
Sex	Female	12 (40%)	14 (46.7%)	0.602
	Male	18 (60%)	16 (53.3%)	
ASA	I	17 (56.7%)	21 (70%)	0.284
	II	13 (43.3%)	9 (30%)	
Hypotension	No	30 (100%)	26 (86.7%)	0.038
	Yes	0	4 (13.3%)	
Nausea/vomiting	No	29 (96.7%)	29 (96.7%)	1
	Yes	1 (3.3%)	1 (3.3%)	

Table 3: Comparison of intraoperative vital parameters and sedation score between groups

	Group A	Group B	P value
Pulse rate (bpm)	74.80 ± 4.69	76.17 ± 5.40	0.299
Systolic blood pressure (mm Hg)	117.33 ± 6.63	116.20 ± 7.97	0.552
Diastolic Blood pressure (mm Hg)	76.93 ± 5.96	78.13 ± 5.58	0.424
Respiratory rate (bpm)	24.43 ± 1.04	14.77 ± 0.57	0.129
Peripheral oxygen saturation (SPO2) (%)	99.93 ± 0.25	99.87 ± 0.35	0.398
Sedation score	1.07 ± 0.25	1.57 ± 0.56	< 0.0001

There were no significant differences in sex, ASA patients, and nausea/vomiting between the groups (p = 0.602, p = 0.284, p = 1.000, respectively). The incidence of hypotension in each group was significantly different (p = 0.038) [Table 2].

There were no significant differences in pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate, and peripheral oxygen saturation between the groups (p = 0.299, p = 0.552, p = 0.424, p = 0.129, p = 0.398, respectively). The sedation scores of both groups were significantly higher in the B group (1.57 ± 0.56) than in the A group (1.07 ± 0.25) (p < 0.0001) [Table 3]. No bradycardia and convulsions occurred in either group.

DISCUSSION

Dexamethasone promotes vasoconstriction, blocks ectopic neuronal discharge, and inhibits inflammatory mediators, enhancing local anaesthetic activity by increasing potassium channel activity in nociceptive C fibres.[4] Midazolam, a short-acting benzodiazepine, enhances local anaesthetic effects through its action on GABA-A receptors, causing chloride ion influx, membrane hyperpolarization, and inhibition of nerve impulse conduction, resulting in antinociceptive and synergistic effects with local anaesthetics.[5]

In our study, we observed that the onset time of sensory block was significantly reduced in the AD group (dexamethasone group) compared to the BM group (midazolam group). The mean onset time of sensory blockade in Group A (Dexamethasone group) was 8.90 ± 0.96 minutes and was 12.57 ± 0.68 minutes in group B (Midazolam group). In El-Baradey et al. study comparing the effectiveness of adding either dexamethasone, midazolam, and epinephrine to 0.5% bupivacaine which showed the mean onset of sensory block was 10.4 ± 4.2 minutes in the dexamethasone group and was 11.5 ± 1.6 minutes in midazolam group.[1]

Iqbal et al. study comparing the additive effect of dexamethasone and midazolam to bupivacaine showed that the mean onset time of sensory blockade in the dexamethasone group was 10.02 ± 1.26 minutes and in the midazolam, the group was 11.07 ± 1.38 minutes.[3] Alarason et al. study showed similar observations for mean time to onset of the sensory block with the addition of dexamethasone to bupivacaine (10.36 ± 1.99 minutes).[6]

In our study, the mean onset time of the motor block was 10.40 ± 1.13 minutes in the AD group (dexamethasone group), which was significantly faster than that in the BM group (midazolam group), where the mean onset time of the motor block was 13.80 ± 0.71 minutes. Godbole et al. showed similar observation in their study with a mean onset of motor block of 9.48 ± 3.24 minutes in the dexamethasone group.[7] Rai et al. observed that the mean onset of motor block was faster in bupivacaine with the dexamethasone group (14.63 ± 2.79 minutes).[8] El Baradey et al study observed a similar mean onset time of motor blockade in bupivacaine with dexamethasone group (11.4 ± 3.6 minutes).[1]

In our study, the mean duration of sensory blockade was 1144 ± 22.98 minutes in group A (dexamethasone group) as compared with 752.33 ± 16.54 minutes in group B (midazolam group), which was significant. Iqbal et al. observed a significantly longer mean duration of sensory block with dexamethasone (19.11 ± 1.43 hours) compared to 13.07 ± 1.43 hours with midazolam.[3] El Baradey et al. also reported a comparable difference in the mean duration of sensory blockade with dexamethasone and midazolam (19.4 ± 2.2 vs 11.5 ± 1.6 hours).[1] Persec et al. observed that the mean duration of sensory block was 1260 min in the dexamethasone and levobupivacaine group compared to 600 min in the plain levobupivacaine group.[9]

In our study, the mean duration of motor blockade was 1124.67 ± 21.77 minutes in group A (dexamethasone group), which was significant and higher than that in group B (midazolam group). El

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Baradey et al. observed that the duration of motor block in the dexamethasone group was 1200 ± 90 minutes as compared to 720±72 minutes in the midazolam group.[1] Jong et al. observed the attributed to the reason that large motor fibres require a larger dose of local anaesthetics than small sensory fibres, the duration of motor blockade was significantly shorter than that of the sensory block.[10] Alfred et al. observed that ultrasound-guided supraclavicular brachial plexus block had a faster onset of sensory and motor block than the nerve stimulator technique.[11]

In our study, the mean analgesia duration was significantly extended in group A (dexamethasone group) by 1199 ± 60.76 minutes as compared to group B (midazolam group) by 806.33 ± 17.90 minutes. Rai et al. reported a similar observation in their study where the mean duration of analgesia with perineural injection of dexamethasone in supraclavicular brachial plexus block was 1160 ± 143.10 minutes.[8] Shrestha et al. reported a similar observation in their study where the mean duration of analgesia when dexamethasone was combined with bupivacaine in a supraclavicular brachial plexus block was 1028 minutes.[12] Liu et al. study compared the analgesic effects of 3 doses of dexamethasone in combination with bupivacaine and observed that the duration of analgesia extended up to 1380 minutes.[13] Similarly, Parrington et al. conducted a study that the longer mean duration of analgesia was observed with dexamethasone.[14]

In our study, dexamethasone was found to be a highly potent anti-inflammatory synthetic glucocorticoid. It reduces postoperative nausea and vomiting and prolongs the duration of the blockade through local action mediated by glucocorticoid receptors. Movafegh et al. study found that the addition of dexamethasone to a local anaesthetic agent significantly prolonged the duration of analgesia.[15] Albrecht et al. reported that the mean duration of analgesia was prolonged by 488 min with the addition of dexamethasone to the local anaesthetic.[16] Moharam et al. noted that the duration of analgesia was prolonged with the addition of midazolam to local anaesthetic when compared with using local anaesthetic alone in the supraclavicular brachial plexus block.[17] A similar observation was also noted in their study by Nasreen Liaq et al. postoperative analgesia was prolonged with midazolam combined with bupivacaine compared to bupivacaine alone in supraclavicular brachial plexus block.[18]

In our study, the sedation score was significantly higher in the B group (midazolam group) (1.57 ± 0.56) than in the A group (dexamethasone group) (1.07 ± 0.25). This could be due to the partial vascular uptake of midazolam and its effects on the central nervous system, where it acts on the GABA receptors. El Baradey et al. found a higher sedation score in the midazolam group (2.4 ± 0.48) than in the dexamethasone group (1 ± 0).[1]

CONCLUSION

Administering 0.5% bupivacaine and dexamethasone in an ultrasound-guided supraclavicular brachial plexus block for patients undergoing elective upper limb procedures resulted in a faster onset of sensory and motor blockade as well as a longer duration of both. Additionally, it maintained stable hemodynamic parameters, caused fewer adverse effects, and provided prolonged postoperative analgesia.

REFERENCES

1. El-Baradey GF, Elshmaa NS. The efficacy of adding dexamethasone, midazolam, or epinephrine to 0.5% bupivacaine in supraclavicular brachial plexus block. Saudi J Anaesth 2014;8: S78-83. https://doi.org/10.4103/1658-354X.144083.
2. Jarbo K. Yatindra kumar batra et al; brachial plexus block with midazolam and bupivacaine improves analgesia. Canadian Journal of Anaesthesia 2005; 52:822–6. https://doi.org/10.1007/BF03021776
3. Iqbal U, Akram M, Khan A, Qureshi A, Sheikh F. Comparison of dexamethasone and midazolam in improving the efficacy of 0.5% bupivacaine in ultrasound-guided supraclavicular brachial plexus block. Prof Med J 2020; 27:1176–81. https://doi.org/10.29309/TPMJ/2020.27.06.3957.
4. Mehta N. Adjuvant drugs to local anesthetics. InTopics in Local Anesthetics. 2020. https://www.intechopen.com/chapters/71663.
5. Teixeira MJ, de Andrade DC, da Silva Paiva W, Welling LC, Rabelo NN, Figueiredo EG. Sedation and analgesia in neurocritical patients. In: Neurocritical care for neurosurgeons. Cham: Springer Int Publ; 2021. p. 241–300.https://link.springer.com/chapter/10.1007/978-3-030-66572-2_15.
6. Alarasan AK, Agrawal J, Choudhary B, Melhotra A, Uike S, Mukherji A. Effect of dexamethasone in low volume supraclavicular brachial plexus block: A double-blinded randomized clinical study. J Anaesthesiol Clin Pharmacol 2016; 32:234–9. https://doi.org/10.4103/0970-9185.182108.
7. Godbole MR, Karhade SS, Parihar PP. A prospective study of comparison of analgesic efficacy of dexamethasone as an adjuvant in supraclavicular block with intravenous dexamethasone after supraclavicular block in patients undergoing forearm surgeries. Anesth Essays Res 2019; 13:31–5. https://doi.org/10.4103/aer.AER_11_19.
8. Rai S, Kedareshvara KS. To compare the efficacy of bupivacaine and bupivacaine with dexamethasone for supraclavicular brachial plexus block in patients undergoing upper-limb surgeries: A one-year randomized controlled trial. Indian J Health Sci Biomed Res Kleu 2018; 11:65–9. https://doi.org/10.4103/kleuhsj.kleuhsj_230_17.
9. 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. https://doi.org/10.1007/s00264-013-2094-z.
10. Jong RH, Edstrom LE. Local anesthetics. Plastic and Reconstructive Surgery-Baltimore 1995;95. https://doi.org/10.1007/BF03021776.
11. Alfred VM, Srinivasan G, Zachariah M. Comparison of ultrasound with peripheral nerve stimulator-guided technique for supraclavicular block in upper limb surgeries: A randomised controlled trial. Anesth Essays Res 2018; 12:50–4. https://doi.org/10.4103/aer.AER_211_17.
12. 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. JNMA J Nepal Med Assoc 2007; 46:158–64.

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https://www.academia.edu/download/52230378/brachial_plexus_block_study.pdf.
13. Liu J, Richman KA, Grodofsky SR, Bhatt S, Huffman GR, Kelly JD 4th, et al. Is there a dose response of dexamethasone as adjuvant for supraclavicular brachial plexus nerve block? A prospective randomized double-blinded clinical study. J Clin Anesth 2015; 27:237–42. https://doi.org/10.1016/j.jclinane.2014.12.004.
14. Parrington SJ, O'Donnell D, Chan VWS, 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. https://doi.org/10.1097/AAP.0b013e3181e85eb9.
15. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. Anesth Analg 2006; 102:263–7. https://doi.org/10.1213/01.ane.0000189055.06729.0a.
16. Albrecht E, Kern C, Kirkham KR. A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. Anaesthesia 2015; 70:71–83. https://doi.org/10.1111/anae.12823.
17. Moharam S, Basuoni A, Abd-elhafez A, Ibrahim A. Evaluation of midazolam as an adjuvant to bupivacaine in supraclavicular brachial plexus block. Tanta Med J 2017; 45:99. https://doi.org/10.4103/tmj.tmj_17_17.
18. Nasreen Laiq, Mohammad Naeem Khan et al; Midazolam with bupivacaine for improving analgesia quality in brachial plexus block for upper limb surgeries; J Coll Physicians Surg 2008;18: 674-8. https://pesquisa.bvsalud.org/portal/resource/pt/emr-87534.

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