Jurnal Saintika Medika
Jurnal Ilmu Kesehatan dan Kedokteran Keluarga
Faculty of Medicine UMM

Vol. 20 No. 1 June 2024
p-ISSN : 0216-759X e-ISSN : 2614-X476X
http://ejournal.umm.ac.id/index.php/sainmed

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

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Receive : April 10th2024. Revised : June 28th2024. Published : July 15th2024

DOI : **https://doi.org/10.22219/sm.Vol20.SMUMM1.33082**

ABSTRACT

Background: To assess the effects of combining Tramadol and Dexamethasone with Bupivacaine in supraclavicular brachial plexus block for upper limb surgeries.

Material and Methods: A clinical research was performed with sixty patients who received upper limb surgery with a supraclavicular brachial plexus block. The study encompassed a total of 60 patients who were divided into two groups, with 30 patients in each group. Group D was administered a blend of Bupivacaine and Dexamethasone, whilst Group T was given a mixture of Bupivacaine and Tramadol, resulting in a combined amount of 25 ml. The study recorded the beginning and length of the sensory and motor block. We meticulously observed the hemodynamic variables throughout the research, until the administration of the first rescue analgesic.

Results: In group D, the mean time for motor block to occur was 5.10±0.92 minutes, whereas in group T, it took 7.93±0.98 minutes. Group D had an average sensory block onset time of 8.23±1.22 minutes, whereas Group T had a slightly longer average onset time of 10.97±1.22 minutes. Group D had an average motor block duration of 560.53±24.46 minutes, whereas group T had a duration of 358.93±20.85 minutes. Group D had a mean duration of sensory block of 745.17±32.81 minutes, whereas group T had a slightly shorter duration of 457.07±16.36 minutes. In group D, the average time for the first rescue analgesia was 961.50±32.94 minutes, whereas in group T, it was 524.17±16.46 minutes.

Conclusion: Inclusion of Dexamethasone led to a noticeably quicker onset of motor and sensory block in comparison to Tramadol. In a recent study, researchers discovered that when Dexamethasone was added to the mix, it had a notable impact on the duration of both motor and sensory block. The effects were significant and promising. When Dexamethasone was added, it noticeably increased the duration until the first rescue analgesia, in comparison to Tramadol.

Keywords : Brachial plexus block, Bupivacaine, Dexamethasone, Tramadol.

INTRODUCTION

Anaesthesia plays a crucial role in the field of medicine on a global scale. (Miller, 2020) Modern anaesthesia has undergone significant development and refinement to facilitate surgical procedures, interventions, pain management, stabilization, and organ support. There have been advancements in the field of Anaesthesia for upper limb surgeries, with different methods being used such as General Anaesthesia, Regional Anaesthesia, and Local Anaesthesia.(Choi et al., 2014, Nagpal et al., 2015, Seger and Cannesson, 2020)

Regional blocks are commonly utilized in comprehensive anaesthesia care and can be safely given to patients of all age groups, as long as the proper technique and patient selection are employed. Regional anaesthesia involves the administration of an anesthetic agent to a peripheral nerve to block pain signals, providing pain relief without affecting the patient's consciousness level. It is distinct from general anaesthesia in this regard.(Persec et al., 2014, Rios et al., 2023, Seger and Cannesson, 2020)

Local anesthetics can be injected at different points along the brachial plexus, depending on the specific surgical procedure being performed. For shoulder and proximal humerus surgeries, the interscalene block is used. For surgeries distal to the mid-humerus, the supraclavicular, infraclavicular, and axillary blocks are utilized. (Morgan & Mikhail, 2018) Supraclavicular block is known for its reliable and efficient anaesthesia of the entire upper extremity, making it a popular choice among different brachial plexus blocks.(Lanz et al., 1983, Shah et al., 2016) Supraclavicular brachial plexus block can be performed using various methods, such as peripheral nerve stimulator guidance, anatomic landmark guidance, and ultrasound guidance. These techniques provide effective anaesthesia and pain relief for upper limb surgery.(Arish et al., 2016, D'Souza and Johnson, 2023, Vloka et al., 2020)

Using ultrasound guidance, the supraclavicular brachial plexus block technique has demonstrated its safety and reliability for upper-limb surgeries, significantly reducing the risk of complications. Local anaesthetic agents such as Bupivacaine, Ropivacaine, and Lignocaine are commonly used for supraclavicular blockade. Among these, Bupivacaine is the preferred choice due to its excellent safety profile. When it comes to nerve blocks, bupivacaine is often the preferred choice among local anaesthetics. This is due to its longer duration of action, increased potency, and lower CNS toxicity compared to other drugs in its class.(Marhofer et al., 2005, Wiles and Nathanson, 2010)

Various additional substances are employed during surgery in combination with local anesthetics to enhance their pharmacological effects, including the speed at which they take effect, the length of time they provide sensory and motor blockage, and the relief of postoperative pain. Various drug adjuncts, such as narcotics, opioids, calcium channel blockers, steroids, and benzodiazepines, are commonly used and their impact on the quality of block is extensively researched. In the present research, Tramadol and Dexamethasone were selected as additional

treatments to local anesthetics in brachial plexus block. Tramadol is known for its dual properties, which contribute to its effectiveness as a pain-relieving medication. Due to its low affinity for μ receptors, it has a lesser effect on respiratory depression.(Estebe et al., 2003, Talukdar et al., 2013)

Dexamethasone is a potent compound renowned for its capacity to alleviate inflammation, alleviate pain, and dampen the immune system. By incorporating dexmedetomidine with local anesthetic in various regional blocks, it is possible to prolong the block's duration and enhance post-operative pain management. Reports indicate that it has been demonstrated to enhance the effectiveness of intrathecal, caudal, and epidural anesthesia. Perineural glucocorticoid is absorbed into the body and has a wide range of effects, including its impact on postoperative pain respite.(Shrestha et al., 2007, Deshpande et al., 2017)

The current study aims to compare and assess the impact of incorporating Tramadol and Dexamethasone with Bupivacaine in supraclavicular brachial plexus block for upper limb procedures. The researchers examined the temporal aspects of sensory and motor blocking, as well as the duration of pain alleviation and potential consequences.

METHODS

A retrospective clinical research was performed on a group of sixty patients scheduled for upper limb surgery. These patients were classified as ASA grade I and II and received a Supraclavicular brachial plexus block. (Ethical Approval Ref No: NHLIRB/03/11/23)

Inclusion Criteria: Subjects between the ages of 18 and 60, classified as ASA grade I and II, were administered either Inj. Bupivacaine + Inj. Tramadol or Inj. Bupivacaine + Inj. Dexamethasone in a Supraclavicular Brachial Plexus Block.

Exclusion Criteria: Subjects who had failure of Onset of block and Patients who were given any other drug along with Inj. Bupivacaine

Patients were given comprehensive information about the procedure, including its advantages and possible drawbacks. The participants were given a sheet of paper containing information about the visual analogue scale (VAS). Individuals can use this scale to assess their pain levels, ranging from 0 to 10. Consent was obtained from the patient and their close relative after providing them with all the necessary information.

Routine investigations: CBC, RFT, LFT, RBS, SERUM ELECTROLYTES, COAGULATION PROFILE, X – RAY CHEST, ELECTROCARGIOGRAM, HIV, and Additional investigations were conducted based on the patient's clinical evaluation.

Two groups of patients were assigned different treatments through a random selection process. Group D was administered an injection of Bupivacaine 0.5% in combination with an injection of Dexamethasone, whereas Group T received an injection of Bupivacaine 0.5% along with

an injection of Tramadol (2ml, 100mg). Every group consisted of 30 patients who underwent a thorough preanesthetic evaluation, including a comprehensive clinical history and systemic examination.

Anesthetic Preparation: Once the intravenous cannula was secured, the medical team proceeded to initiate intravenous fluids (Inj. RL 10-15 ml/kg) in the operation theatre. Heart rate (HR), blood pressure (BP), electrocardiogram (ECG), and oxygen saturation (SpO2) were measured through standard monitoring. Before the surgery, all patients were given a pre-medication of Inj. Glycopyrrolate 0.004 mg/kg IV. Prior to the procedure, vitals were recorded.

Anesthetic Technique: Position the arm to be anaesthetized by bringing it close to the body and extending the hand towards the knee on the same side. The local site was carefully prepared and sterilised with aseptic and antiseptic measures in place. Positioning the linear transducer of an ultrasound machine in the transverse plane just above the clavicle, slightly towards the back, allows for the localization of the brachial plexus. A needle measuring 23-gauge and 1.5 inches in length was carefully inserted towards the brachial plexus, moving from the side to the centre. With precision and attention to detail, the needle was guided to the intended destination. The local anaesthetic was then administered after ensuring there was no presence of blood or air.

The specified amount of drug solution was given after ensuring there was no aspiration around the brachial plexus. Following the injection, the region was delicately manipulated to ensure uniform dispersion of the medication within the plexus. The termination of the injection was designated as time zero minutes. (immediate).

An assessment was conducted on the sensory block in the hand and forearm. This evaluation involved using Hollman's scale to perform a pin prick test. The motor block was evaluated utilising the modified Bromage scale.

Onset of block:

Motor block: Estimating the onset of motor block involves determining the time it takes for the drug to be injected and for the Modified Bromage Grade to reach ≥ 1.

Sensory block: The onset of sensory block was determined by measuring the time between the end of the drug injection and the attainment of Hollman's Grade ≥ 2.

Duration of block:

- Motor block: The duration was measured as the time it took for the motor blockade to start and for complete motor function to be regained (Grade - 0).
- Sensory block: The duration was measured as the period between the start of the sensory block and the moment when the patient first experienced pin prick sensations again after the surgery. (Hollman's Grade - 1).

The study only included patients who had a complete motor and sensory block. The definition of complete blockade involves a sensory blockade of Hollman's Grade ≥ 3 and a motor blockade of Modified Bromage Grade ≥ 2. Once the motor and sensory blocks were fully achieved, the surgery commenced and the start time was recorded. A dose of 1 mg of Midazolam was administered intravenously, and intravenous fluids were maintained at a rate of 2ml/kg/hour throughout the surgery.

Hemodynamic vitals were recorded preoperatively and at intervals as mentioned in the chart upto total of 1200 mins (20 hours). Sedation was assessed by Campbell Sedation score. VAS score for pain was evaluated as per charting and in between whenever patient complained of pain.

Time for first rescue analgesia (mins) :

It was measured as the period from when the sensory block started until the patient reported a VAS score of ≥4. When the VAS score reached 4 or higher, it was determined that the drug's pain-relieving effects had ended. To provide additional relief, an injection of Diclofenac 1.5 mg/kg IV was administered.

Statistical analysis:

The confidence level and level of significance for all tests were set at 95% and 5% respectively.

RESULTS and DISCUSSION

In our study, we utilized Bupivacaine, one of the local anesthetics currently available. The duration of analgesia with plain Bupivacaine is limited by time. Several studies have explored different methods to extend the duration of pain relief.(Shaikh and Veena, 2019, Alarasan et al., 2016, Brummett and Williams, 2011)

Present research was performed evaluating the effects of Dexamethasone (8mg) and Tramadol (100mg) when added to local anaesthetic (Bupivacaine) in brachial plexus block. A total of sixty patients, with diverse age and sex, participated in the study focusing on upper limb surgeries. Our goal was to assess and contrast the speed at which the effects take hold, how long they last, the time it takes for pain relief to be administered, any changes in blood pressure during the procedure, and any potential complications.(Choi et al., 2014, Raj et al., 2017, Vengadessane et al., 2020)

The Table 1 indicates that there are no notable variations in the age, weight, gender, and ASA status of subjects between the two groups. ($p>0.05$).

Our investigation found that the duration of operation was similar in both groups. Group D had a significantly lower mean onset of motor and sensory block compared to Group T, indicating a significant statistical difference. The statistical significance level was found to be less than 0.05. Dr. Taggarsi(Taggarsi, 2016) examined that the average time for motor blockade to occur was 12.93±2.15 minutes in the

Dexamethasone group and 13.07±1.36 minutes in the Tramadol group. Similar findings observed by Shrestha et al.(Shrestha et al., 2007) (Table 2).

Our study observed no statistically significant disparity in heart rate, systolic blood pressure, diastolic blood pressure, SpO2, and respiratory rate between the two groups during the perioperative period. All patients maintained a stable hemodynamic status during the perioperative period, without requiring any pharmacological intervention. In a study conducted by Dr. Chankiran Yadav and colleagues (Dr. Chandkiran Yadav, 2018), Ruchik Solanki et al (Solanki et al., 2019) and Dr. Haribaskar et al (CHENNAI, 2013), similar findings were observed.

Table 1. Demographic data

Parameters	Group D		Group T		p Value	Inference
	Mean	SD	Mean	SD		
Age in Years	36.30	9.15	35.33	10.25	0.701	NS
Weight in Kgs	57.10	7.58	56.70	6.19	0.824	NS
Male:Female	17	13	18	12	0.793	NS
ASA Grade I:II	12	18	13	17	0.793	NS

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Table 2. Duration of Surgery

Parameters	Group D	Group T	p Value
Duration of Surgery in mins	93.00±24.80	91.00±21.07	0.738

The table 3 shows a significant difference in the average time it takes for sensory and motor block to occur between Group D and Group T ($p<0.05$). The patients exhibited no statistically significant alterations in their perioperative heart rate and blood pressure (systolic and diastolic) ($P>0.05$). Both groups consistently maintained similar amounts of these components. There were no significant variations in the mean respiratory rate and SpO2 (Oxygen saturation) between the patients in both groups ($P>0.05$). Furthermore, these metrics demonstrated similar results throughout the perioperative period.

Table 3. Onset of Motor and Sensory Block

Parameters	Group D	Group T	p Value	Inference
Onset of Motor Block (min)	5.10±0.92	7.93±0.98	<0.0001	S
Onset of Sensory Block (min)	8.23±1.22	10.97±1.22	<0.0001	S

Upon doing a comparison between the two groups, it was shown that Group D had notably longer average durations for motor block, sensory block, and 1st rescue analgesia in comparison to Group T. ($P<0.05$) (Tables 4,5 and Figure 1).

Any complications related to drugs and procedures like Tachycardia/Bradycardia, Hypertension/Hypotension, Breathlessness, Pneumothorax, Hematoma, Respiratory depression along with CNS toxicity were not observed in every patients during the study.

Three out of thirty patients in group T had a sedation score of 2, indicating that they were awake and comfortable and rest all 27 patients were wide awake, whereas all patients of the group D were wide awake throughout the surgery, concurring that Tramadol doesnot produce heavy sedation. This was in conjunction with Dr. Chandkiran Yadav and Dr. Haribaskar et al.

Our research has revealed that when Dexamethasone and Tramadol are added to plain Bupivacaine (0.5%) in supraclavicular block, there is a notable increase in the duration of motor and sensory block.

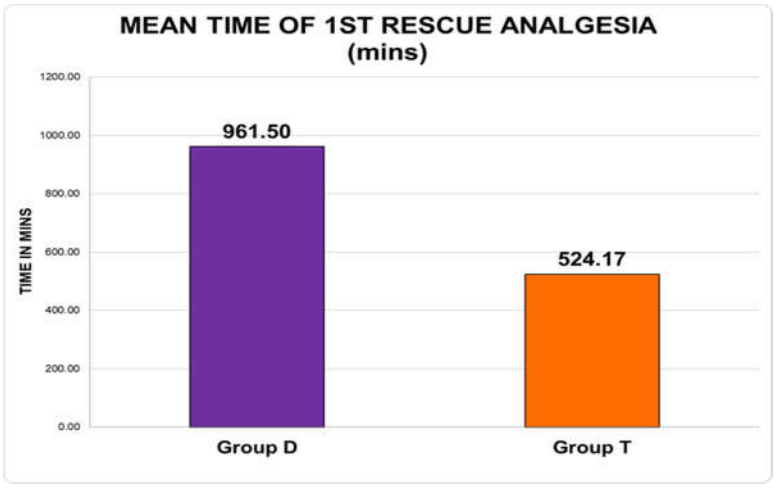
Our investigation revealed a significant disparity in the duration it required for the initial administration of rescue analgesia between Group D (961.50±32.94 mins) and Group T (524.17±16.46 mins). This finding aligns with a similar study conducted by Shrestha et al (Shrestha et al., 2007), Dr. Chandkiran Yadav et al, Regmi NK et al (Regmi et al., 2015) and Ruchik Solanki et al.

Table 4. Sedation Score

Campbell Sedation Score	Group D	Group T
1	30	27
2	0	3
3	0	0
4	0	0

Table 5. Duration of Motor and Sensory Block and Time of First Rescue Analgesia

Parameters	Group D	Group T	p Value	Inference
Duration of Motor block (min)	560.53±24.46	358.93±20.85	<0.0001	S
Duration of Sensory Block (min)	745.17±32.81	457.07±16.36	<0.0001	S
Time of 1st rescue Analgesia (min)	961.50±32.94	524.17±16.46	<0.0001	S



Graph 1: Mean Time of First Rescue Analgesia

No patients suffered any complications in the group D, which further reiterates that addition of Dexamethasone is much more beneficial than that of Tramadol which does have a few side effects. Emphasizing that our research included a small participant pool, which may affect how widely our findings can be applied. To reach more robust conclusions, it's crucial for upcoming research to include larger sample sizes.

CONCLUSION

The hemodynamic characteristics of subjects in both groups were similar. Dexamethasone administration led to a notable reduction in the time it took for the motor and sensory block to occur, in comparison to Tramadol. The use of Dexamethasone resulted in a significant extension of both the motor and sensory block duration, in comparison to Tramadol. Dexamethasone administration led to a substantial increase in the duration until the first rescue analgesia, in comparison to Tramadol. Administering dexmedetomidine at a dosage of 1 mg/kg could be a favorable option as an adjunctive therapy for supraclavicular brachial plexus block, as it induces drowsiness without causing any detrimental impact on blood pressure or other undesirable symptoms.

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