Section: Anaesthesia

Original Research Article

EFFECT OF TRAMADOL AS AN ADJUVANT WITH BUPIVACAINE IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER EXTREMITY SURGERIES

Received : 17/08/2023
Received in revised form : 10/09/2023
Accepted : 21/09/2023

Keywords:
Bupivacaine, tramadol, supraclavicular brachial plexus.

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DOI: 10.47009/jamp.2023.5.5.266

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (5); 1346-1351

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Abstract

Background: The present study is being undertaken to evaluate the efficiency of Bupivacaine (0.5%) and Tramadol (100mg) as an adjuvant to Bupivacaine (0.5%) in ultrasound guided brachial plexus block by supraclavicular approach with regard to the following parameters: - Onset and duration of sensory blockade, Onset and duration of motor blockade, Time of first rescue analgesic requirement, Perioperative hemodynamic variables and Untoward adverse effect. **Materials and Methods:** A prospective, randomized, controlled study was undertaken in patients scheduled for upper limb surgeries under ultrasound guided supraclavicular block. They were divided into two groups: group B: Inj. Bupivacaine 0.5% 18 ml +Inj. Normal Saline 2 ml, group BT: Inj. Bupivacaine 0.5% 18 ml +Inj. Tramadol 2 ml (100 mg). The patients were observed for sensory, motor onset along with duration of sensory and motor block. Patients were monitored for sedation and hemodynamic parameters during intraoperative and postoperative period. Pain free period and demand for rescue analgesia was noted in all the patients. **Result:** The study demonstrates that tramadol as an adjuvant with bupivacaine prolongs the duration of sensory, motor block and demand for rescue analgesia as compared to bupivacaine alone. **Conclusion:** From our study we conclude that use of Tramadol (100 mg) as an adjuvant to Bupivacaine 0.5% in ultrasound-guided supraclavicular brachial plexus block for upper extremity surgery appears to prolong the duration of sensory block, the duration of motor block and time of first rescue analgesic requirement without any significant.

INTRODUCTION

The supraclavicular brachial plexus approach is an alternative technique to general anaesthesia, resulting in rapid onset of reliable blockade of the brachial plexus, to provide excellent anaesthesia for elbow, forearm and hand surgery and also provides good postoperative analgesia of short duration, even when a long-acting local anaesthetic like bupivacaine is used alone.

Bupivacaine an amide local anesthetic when compared to other local anesthetic drugs has lesser CNS toxicity but has longer duration of action and increased potency, hence it has been preferred to other local anesthetics for nerve blocks.[1]

To extend the analgesia use different additives in local anaesthetics like narcotics, opioids, calcium channel blockers and benzodiazepine have been added to the local anaesthetics and their effect on the quality of block studied.[2]

A variety of opioids have been studied for brachial plexus blockade including tramadol hydrochloride. Tramadol is a synthetic 4-phenyl-piperidine analogue of codeine with mixed μ opioid and non opioid activity. It also has peripheral local anesthetic properties and in addition to it, when compared to other opioids has less respiratory depressant effect. This led to its use as an additive in peripheral nerve blocks.[3]

Ultrasound guided supraclavicular brachial plexus block shortens block performance time, improves sensory and motor block, and reduces the need for block supplementation.[4]

The present study is being undertaken to evaluate the efficiency of Bupivacaine (0.5%) and Tramadol (100mg) as an adjuvant to Bupivacaine (0.5%) in

ISSN (O): 2687-5365; ISSN (P): 2753-6556

ultrasound guided brachial plexus block by supraclavicular approach with regard to onset time, duration and postoperative analgesia.

Aims and Objectives of Study

To evaluate the effects of adding tramadol (2 mg/kg) as an adjuvant to bupivacaine (0.5%) in ultrasound guided brachial plexus block by supraclavicular approach with regard to the following parameters:

- Onset time and duration of sensory blockade
- Onset time and duration of motor blockade
- Duration of analgesia
- Hemodynamic variables
- Untoward adverse effect

MATERIALS AND METHODS

Design: Prospective Randomized control study

Inclusion Criteria

- ASA class I and II posted for elective upper limb surgeries
- Age: 18 to 55 years
- Sex: Male or Female

Exclusion Criteria

- Any bleeding disorder or patient on anticoagulants
- Neurological deficit involving brachial plexus
- Allergy to local anaesthetics
- Local infection at the injection site
- Patients suffering from any cardiac or respiratory disease

RESULTS

All the patients underwent a thorough pre-anaesthetic checkup with necessary investigations.

Patients were randomly divided into two groups.in group B patients were received inj. Bupivacaine 0.5% 18 ml + Inj. NS 2 ml or in group BT patients were received Inj.Bupivacaine 0.5% 18ml + Inj.Tramadol 2ml (100mg) as considered suitable by the treating anaesthetics.

Pre operative pulse, Blood pressure, Spo2 and VAS were recorded. After establishing intravenous access, an infusion of Ringer Lactate was started.

Anaesthesia technique: "Ultrasound Guided Supraclavicular Brachial Plexus Block"

- The ultrasound guided block was performed in supine position with his/her head turned in the direction opposite the limb to be anaesthetised.
- The arm to be anaesthetised should be place in neutral position along the side of body.
- Position the probe on the neck directly above the clavicle in the supraclavicular fossa. At this level, the plexus was configured as trunks or divisions and is typically located lateral and slightly superior to the subclavian artery at a depth of 2 to 4 cm.

Block characteristics: Sensory Block - Sensory block was assessed by pin prick test in areas innervated by nerves of brachial plexus in hand and forearm.

Assessment of sensory block by Hollman's scale:

Hollman's scale	
1	Normal sensation of pinprick
2	Pinprick felt sharp but weaker compared with the same area in the other limb
3	Pinprick recognized touch with blunt object
4	No Perception of Pinprick

Onset of sensory block was taken as abolishment of pin prick sensation (Hollman's ≥ 3). Onset of sensory block was defined as time interval starting from drug injection till achievement of complete sensory block. Duration of sensory block was taken as the time from onset of sensory block to the first-time pin prick sensations are felt again by the patient during post-operative period (Hollman's -1).

Motor Block: Motor block: By Modified Bromage scale for upper limb surgeries

Grade	Criteria
GRADE 0	Normal motor function with full flexion and extension of elbow, wrist, and fingers
GRADE 1	Decreased motor strength with ability to move the fingers only
GRADE 2	Complete motor block with inability to move fingers

Onset of motor blockade: Attaining a score of 2 was considered as the onset of motor block

Duration of motor block: The time interval from the onset to the recovery of complete motor function (MBS score 0).

Duration of analgesia: Taken from the time of the onset of block to appearance of pain requiring first supplement analgesia (VAS score > 4).

Rescue Analgesia: Time at which VAS score is > 4 is noted and the patient was given rescue analgesic in the form of inj. Diclofenac sodium intravenously in the dose of 1.5mg/kg.

Sedation score: Sedation was assessed by Campbell Sedation score.

1	Wide awake
2	Awake and comfortable
3	Drowsy and difficult to arouse
4	Not arousable

Visual Analogue Scale (VAS) Score

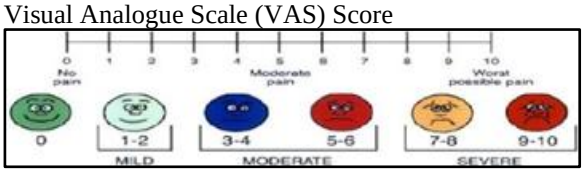

Table 1: Demographic Data

	Group-B	Group-BT	P Value	Inference
Age(years) (Mean±SD	37.26±9.32	36.83±9.10	0.8571	NS
Weigh t(KG) (Mean±SD)	55.93±6.24	57.4±6.70	0.3828	NS
Sex (M:F)	17/13	16/14		

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ASA grade (I:II)	15/15	14/16		
Duration of surgery (MIN) (Mean±SD)	92.66±20.16	93.66±23.99	0.8619	NS

[Table 1] shows no significant differences in age, weight, male-female ratio and ASA grade of patients and mean duration of surgery between two groups.

Table 2: Baseline Vital Parameter

VITALS	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value
Pulse (per min)	81.1±5.53	79.86±5.62	0.392
SBP (mmHg)	120.73±7.60	123.46±7.42	0.1645
DBP (mmHg)	81.06±4.41	82±4.13	0.3976
MAP (mmHg)	94.28±4.90	95.82±4.59	0.214
SPO2 (%)	98.4±0.85	98.43±0.77	0.8866

[Table 2] shows there was no statistically significant difference in baseline hemodynamic parameters in both groups (P>0.05).

Table 3: Onset of Sensory And Motor Block

ONSET	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value	Inferen
Sensory (min) block	9.13±1.63	8.23±1.90	0.0537	NS
Motor (min) block	14.13±1.83	13.33±1.84	0.0967	NS

[Table 3] shows no significant differences in mean time of onset of sensory and motor block in Group B and Group BT (P>0.05)

Table 4: Perioperative Changes In Pulse Rate (Per Minute)

TIME	GROUP-B(Mean±SD)	GROUP-BT (Mean±SD)	P Value
Immediate	80.56±4.27	79.76±5.54	0.5335
5 min	79.66±4.78	78.23±6.52	0.3367
10 min	78.13±5.56	76.13±6.00	0.1857
15 min	76.56±6.14	74.83±5.60	0.2589
30 min	74.93±5.66	73.56±5.91	0.3629
1 hrs	74.36±5.56	71.93±5.80	0.103
1.5 hrs	73.53±5.48	72.33±5.99	0.4215
2 hrs	72.96±6.04	73.96±5.85	0.5174
4 hrs	74.2±5.92	75.23±6.46	0.5222
6 hrs	74.86±6.08	77.66±4.95	0.0553
9 hrs	76.56±5.38	77.73±5.29	0.3992
12 hrs	77.73±5.65	79.83±5.19	0.1392
24 hrs	79.13±5.07	80.16±4.75	0.4201

[Table 4] shows there is no statistically significant difference in perioperative pulse rate in both groups (P>0.05).

Table 5: Perioperative Changes In Systolic Blood Pressure (mmHg)

TIME	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value
Immediate	120.33±7.26	122.66±7.13	0.2148
5 min	119.93±6.81	121.06±6.49	0.5132
10 min	119.26±6.83	120.66±6.75	0.4278
15 min	118.2±6.73	119.86±6.36	0.3302
30 min	117.66±5.82	118.53±6.12	0.5748
1 hrs	117.26±5.34	117.73±6.84	0.7678
1.5 hrs	116.86±7.19	116.66±6.15	0.9082
2 hrs	115.93±6.63	115.73±6.65	0.9075
4 hrs	115.20±5.90	116.93±6.67	0.2917
6 hrs	116.73±6.79	117.93±7.22	0.5099
9 hrs	117.53±6.44	118.86±6.65	0.4345
12 hrs	118.13±5.89	120.93±6.23	0.0789
24 hrs	119.73±6.16	121.66±6.26	0.2336

[Table 5] shows that there is no statistically significant difference in perioperative systolic blood pressure in both groups (P>0.05).

Table 6: Perioperative Changes In Diastolic Blood Pressure (mmHg)

TIME	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value
Immediate	80.86±4.28	81.53±4.53	0.5583
5 min	79.93±4.47	80.33±5.51	0.7586
10 min	79.06±4.66	79.46±5.89	0.7715
15 min	79.46±4.29	78.46±5.64	0.4427

ISSN (O): 2687-5365; ISSN (P): 2753-6556

30 min	78.86±4.91	77.53±5.86	0.3446
1 hrs	78.13±4.84	76.46±7.04	0.2888
1.5 hrs	77.6±5.85	75.33±7.43	0.1938
2 hrs	76.53±6.47	73.53±6.96	0.0891
4 hrs	76.13±6.00	73.93±7.95	0.2313
6 hrs	77.8±5.99	74.86±7.32	0.094
9 hrs	78.06±5.76	76.53±7.14	0.3648
12 hrs	79.53±5.55	78.13±6.05	0.3542
24 hrs	79.86±4.78	80.2±5.36	0.7963

[Table 6] shows that there is no statistically significant difference in perioperative diastolic blood pressure in both groups (P>0.05).

Table 7: Perioperative Changes In Mean Arterial Pressure (mmHg)

TIME	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value
Immediate	94.02±4.12	95.24±4.50	0.2779
5 min	93.26±3.58	93.91±4.76	0.5523
10 min	92.46±4.60	93.2±5.64	0.5797
15 min	92.37±4.30	92.26±5.48	0.9314
30 min	91.8±4.69	91.2±5.52	0.6517
1 hrs	91.17±4.23	90.22±6.38	0.4994
1.5 hrs	90.68±5.73	89.11±6.36	0.3193
2 hrs	89.66±5.98	87.6±5.99	0.1877
4 hrs	89.15±5.18	88.26±6.36	0.5546
6 hrs	90.77±5.77	89.22±5.83	0.305
9 hrs	91.22±5.47	90.64±5.07	0.6717
12 hrs	92.4±5.29	92.4±4.36	1
24 hrs	93.15±5.03	94.02±3.91	0.4575

[Table 7] shows that there is no statistically significant difference in perioperative mean arterial pressure in both groups (P>0.05).

Table 8: Perioperative Changes In Oxygen Saturation (SpO2)

TIME	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value
Immediate	98.33±0.92	98.63±0.71	0.1627
5 min	98.36±0.99	98.33±0.84	0.8997
10 min	98.43±0.85	98.46±0.81	0.8892
15 min	98.56±0.81	98.5±0.82	0.7766
30 min	98.46±0.89	98.53±0.73	0.9958
1 hrs	98.23±1.00	98.26±1.01	0.9084
1.5 hrs	98.2±0.88	98.33±0.95	0.5845
2 hrs	98.16±0.94	98.23±0.97	0.7775
4 hrs	98.5±0.82	98.46±0.86	0.8544
6 hrs	98.43±0.85	98.23±1.00	0.4073
9 hrs	98.53±0.73	98.43±0.97	0.6535
12 hrs	98.4±0.81	98.33±0.84	0.7437
24 hrs	98.43±0.77	98.43±0.77	1

[Table 8] shows that there is no statistically significant difference in perioperative oxygen saturation in both the groups (P>0.05).

Table 9: duration of sensory and motor block

Duration of Block	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value	Inference
Sensory block(min)	205.33±15.27	456.13±15.79	<0.0001	HS
Motor block(min)	161.23±13.78	358.83±18.98	<0.0001	HS

[Table 9] shows mean duration of motor and sensory block are significantly longer in Group BT as compared to Group B(P<0.0001).

Table 10: mean time of first rescue analgesic requirement (VAS≥4)

Time of first rescue analgesia	GROUP-B (Mean±SD)	GROUP-BT (Mean±SD)	P Value	Inference
Time (min)	254.93±13.34	522.66±16.33	<0.0001	HS

[Table 10] shows that Mean time for first analgesic requirement for Group BT is (522.66±16.33 min)and it is significantly longer than that in Group B (254.93±13.34 min) (P<0.0001).

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Table 11: perioperative complications

Complication	GROU P-B	GRO UP-BT
Tachycardia/Bradycardia	0	0
Horner'ssyndrome	0	0
Cardiotoxicity/Hypotension	0	0
Cough	0	0
Breathlessness	0	0
Pneumothorax	0	0
Hematoma	0	0
Respiratory Depression	0	0
Other neurological sequelae	0	0
Nausea and Vomiting	0	0
CNS toxicity	0	0

No Complications were observed in either group.

Sedation: All patients were widely awake. None of the patients were heavily sedated in both the groups

DISCUSSION

Supraclavicular approach to brachial plexus block involves injection of local anaesthetic around the divisions of the brachial plexus, deep to the prevertebral fascia, posterolateral to the subclavian artery. Due to the compact arrangement of all the three trunks of plexus in this region, this block provides complete regional anaesthesia for the surgeries on the distal arm, elbow, forearm, wrist or hand.

Local anaesthetics can provide analgesia for a limited period of time when used as a single injection. Therefore, various agents are used as an adjuvant to local anaesthetic to prolong analgesia. A variety of opioids have been studied for brachial plexus blockade including Tramadol hydrochloride.

Tramadol is known to produce antinociception and enhances the effect of local anaesthetic.

Tramadol produces this effect by its dual mechanism of action. Firstly, it stimulates μ receptor and to lesser extent δ and κ - opioid receptors. Secondly, it activates spinal inhibition of pain. previous studies have shown that ultrasound-guided supraclavicular block extends the duration of analgesia as it allows more accurate drug deposition closer to the nerve fibers. Using ultrasound, the incidence of block-related complications are reduced. Abrahams et al,[5] concluded that blocks performed using ultrasound guidance were more likely to be successful, took less time to be performed, had faster onset of action, and had longer duration of blockade. Ultrasound guidance also decreased the risk of vascular puncture during block performance.

The particular dose of Tramadol (100mg) was selected after previous studies like Stephan Kapral et al,[6] Antonucci et al,[7] Geze et al,[8] and Dr. Haribaskar et al,[9] used the same dosage in peripheral nerve blocks without any significant adverse effects.

We studied 60 randomly selected patients who were undergoing upper limb surgeries and administered Bupivacaine 0.5% and Tramadol 100mg as adjuvant to 0.5% Bupivacaine in supraclavicular brachial plexus block, using ultrasound guided techniques

Demographic Variables: In our study, both groups were comparable with respect to age, gender, weight and ASA grade of the patients. No significance difference was found in between two groups ($p>0.05$).

Onset of Sensory and Motor Blockade: In our study there was no significant difference in the onset of motor and sensory blockade between the two groups. Mean onset of sensory block was 9.13±1.63 min in Group B and 8.23±1.90 min in group BT. Mean onset of motor blockade in group B was 14.13±1.83 min and in Group BT was 13.33±1.84 min.

Abdelazim A. T. Hegazy et al,[10] found that the onset of sensory and motor block was 7.12±1.72 min and 13.71±1.83 min with Tramadol. The Onset of sensory and motor block without Tramadol was 7.39±1.00 min and 14.65±1.37 min.

Regmi NK et al,[11] evaluated efficacy of Tramadol 100mg as an adjuvant to Bupivacaine in supraclavicular brachial plexus block and they observed that the onset of sensory and motor block was 16.63±2.70 min and 16.86±3.67 min and 23.10±4.34 min.

Stephan Kapral et al,[6] also noted that 100mg Tramadol does not have influence on onset of anaesthesia.

The likely explanation for faster onset of sensory and motor blockade could be that ultrasound can determine the size, depth and exact location of the brachial plexus and its neighboring structures. Also with USG guidance, positioning and if required repositioning of the needle is performed under direct vision and in real time.

Duration of sensory and motor block: In our study, the mean duration of sensory block was found to be 456.13±15.79 min in Group BT and 205.33±15.27 min in Group B. The duration of sensory block in Group BT was significantly longer as compared to Group B ($P<0.001$).

Mean duration of the motor block was 358.83±18.98 min in Group BT and 161.23±13.78 min in Group B. The duration of motor block in Group BT was more ($P <0.001$).

Thus, duration of sensory and motor block in Group BT was significantly longer than Group B.

Dr. Haribaskar et al,[9] found that the duration of sensory block was 5.88±0.669 hrs with Tramadol and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

3.18±0.524 hrs without Tramadol. Duration of the motor block was 4.65±0.654 hrs with Tramadol and 2.34±0.362 hrs without Tramadol.

Suresh C et al,[12] also found that the duration of sensory block was 5.65±0.52 hrs with Tramadol and 3.23±4.51 hrs without Tramadol. Duration of the motor block was 4.50±0.57 hrs with Tramadol and 2.10±1.01 hrs without Tramadol.

Time of first rescue analgesic requirement: The time of first rescue analgesic requirement was when VAS ≥4 and 1st dose of rescue analgesic given.

In our study the time of first analgesic requirement in Group BT 522.66±16.33 min as compared to 254.93±13.34 min in Group B which means duration of first analgesic requirement was significantly longer in Group BT ($P < 0.0001$).

Regmi NK et al,[11] evaluated efficacy of Tramadol 100mg as an adjuvant to Bupivacaine in supraclavicular brachial plexus block and9Dr. Haribaskar et al found that the duration of analgesia was 7.06±2.894 hrs with Tramadol and 3.42±0.283 hrs without Tramadol.

Abdelazim A. T. Hegazy et al,[10] did study of Dexmedetomidine versus Tramadol as an adjuvant to Bupivacaine (0.5%) in ultrasound-guided supraclavicular brachial plexus block and found that the first experience of pain was 9.16±2.19 hrs with Tramadol.

Perioperative hemodynamics: In our study, there was no significant difference in heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and respiratory rate found between the two groups perioperatively. During the perioperative period hemodynamics remained stable in a consistent manner.

Dr. Haribaskar et al,[9] in his study that there were no hemodynamic changes in the Tramadol group as compared to the control group.

Regmi NK et al,[11] found that there was no significant difference in hemodynamic parameters between without Tramadol and with the Tramadol group

Sedation: Tramadol as adjuvant did not produce heavy sedation in our study.

Dr. Haribaskar et al,[9] found that Tramadol as adjuvant to Bupivacaine did not produce sedation.

Complications: In our study no major complications like nausea, vomiting, bradycardia, pneumothorax, signs and symptoms of local anaesthetic toxicity and respiratory depression were noted in both the groups. The lack of significant side effects like respiratory depression and sedation make Tramadol as an adjuvant for supraclavicular brachial plexus block.

Dr. Haribaskar et al,[9] in his study of Tramadol with 0.25% Bupivacaine in supraclavicular brachial plexus block noticed no significant side effects or respiratory depression or any complications.

Suresh C et al,[12] found no complications in his study of Tramadol as an adjuvant to 0.25% Bupivacaine in supraclavicular block.

CONCLUSION

From our study we conclude that use of Tramadol (100 mg) as an adjuvant to Bupivacaine 0.5% in ultrasound-guided supraclavicular brachial plexus block for upper extremity surgery appears to prolong the duration of sensory block, the duration of motor block and time of first rescue analgesic requirement without any significant complication like respiratory depression and sedation was observed.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556