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Role of TRAMADOL as an Adjuvant to Local Anesthetics in Brachial Plexus Block

KEYWORDS: Brachial plexus block, local anesthetics, tramadol

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ABSTRACT Local anesthetic mixtures are used for peripheral nerve blocks to accelerate the onset time of sensorial and motor blocks. Brachial plexus blocks provide a useful alternative to general anesthesia for upper limb surgery. Also certain drugs like opioids, α2 adrenergic agonist, sodium bicarbonate, neostigmine, adrenaline, ketamine etc. are used as adjuvant to local anesthetics to lower doses of each agent and enhance analgesic efficacy while reducing the incidence of adverse reactions. In this study we compared the effect of tramadol versus placebo as adjuvant to bupivacaine for brachial plexus block, by supraclavicular approach, for upper limb orthopedic procedures of moderate duration. After receiving institutional ethical committee approval study was conducted in 50 patients of ASA I or II status in the age group of 18-50 years. The patients were randomly divided into two groups. Patients in group A received 30ml 1.5% lignocaine with adrenaline(1:2,00,000), 10ml bupivacaine 0.5% and 1ml saline while those in group B received 30ml 1.5% lignocaine with adrenaline(1:2,00,000), 10ml bupivacaine 0.5% with tramadol(100mg). Both groups were compared for the duration of satisfactory analgesia from the time when the block was performed and the time for first administration of rescue analgesic.

AIMS OF THE STUDY :

This study was carried out to study efficacy of injection TRAMADOL (100 mg) as adjuvant to supraclavicular brachial plexus block using 30 ml Lignocaine with adrenaline (1:2,00,000) 1.5%, 10 ml bupivacaine 0.5% in adult patients (ASA Grade I and II).

Patients of both groups were assessed in terms of:

- Onset time of motor blockade
- Onset time of sensory blockade
- Perioperative hemodynamic status
- Duration of postoperative analgesia
- Time of 1st rescue analgesia

MATERIALS AND METHODS :

The present study was conducted in 50 patients of ASA I and II status in the age group of 18-50 years under brachial plexus block by supraclavicular approach for various upper limb surgeries, after receiving institutional ethical committee approval. Patients excluded from the study were for whom supraclavicular brachial plexus block or the study medications were contraindicated or those who had a history of significant neurological, psychiatric, neuromuscular, cardiovascular, pulmonary, renal or hepatic disease or alcohol or drug abuse, as well as pregnant or lactating women.

PRE-OPERATIVE EVALUATION

1. Detailed pre anesthetic check-up was done when patients were referred in pre anesthetic clinic. Patients having local infection over supraclavicular area, bleeding diathesis, mental retardation or neurological deficit were excluded from study group.
2. Routine laboratory tests like hemoglobin, renal function test, serum electrolytes, urine examination, random blood sugar and chest X-ray were done in all cases.
3. Patients were explained about the procedure in detail and written consent was obtained.
4. All patients were instructed to fast for minimum 6 hours prior to scheduled time of surgery.

No patients received any sedative and narcotic premedication before arrival in operation theatre. On arrival in the operation theatre ECG, Pulse oximeter, blood pressure cuff were applied and baseline pulse, blood pressure, oxygen saturation and respiratory rate were noted, Intravenous line was secured with 18 G intravenous cannula and inj. ringer lactate was started in all patients.

Brachial plexus block was performed using a supraclavicular approach by classic technique. The patient was placed in the supine position, with the head turned away from the side to be blocked and the ipsilateral arm adducted. The inter-scalene groove and mid point of the clavicle were identified and a mark 1.5 to 2.0cm above and posterior to the midpoint of clavicle was made. Palpation of the subclavian artery at this site confirmed the landmark.

After aseptic preparation of the area, a skin wheal was raised at the marked point with 1 ml lignocaine 1% subcutaneously, next standing at the side of patient, facing the patient's head, a 23 G- 3.75cm needle was directed in a caudal slightly medial and posterior direction. A nerve stimulator was used to locate the brachial plexus. The location end point was a distal motor response with an output lower than 0.7ma. On localization of the brachial plexus and negative aspiration of blood, the study medication was injected.

The patients were randomly divided into two groups. Patients in group A received 30ml 1.5% lignocaine with adrenaline(1:2,00,000), 10ml bupivacaine 0.5% and 1ml

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saline while those in group B received 30ml 1.5% lignocaine with adrenaline(1:2,00,000), 10ml bupivacaine 0.5% with tramadol(100mg).The assessment for onset of sensory and motor block was done every minute from the time of test drug until the block was established.Sensory block was evaluated by pinprick test in hand and forearm whereas motor block was assessed by asking the patient to adduct the shoulder and flex the forearm and hand against gravity.

Onset of sensory block was defined as time elapsed between injection of drug and complete loss of pin prick sensation, while onset of motor block was defined as the time elapsed from injection of drug to inability to flex and extend forearm. Only patients with complete sensory block were included in the study.After the establishment of block, surgery was started and time of beginning of surgery was noted. Intravenous fluids were continued intra operatively at a rate of 2ml/kg/hour. Intra operatively pulse, BP, SPO2 and ECG were monitored every half hourly.

During the procedure, anesthesia was considered satisfactory if patient did not complain of any pain or discomfort. Any patient requiring supplemental anesthesia was excluded from the study. All 50 patients were monitored for anesthesia and analgesia up to 15 hours in the post-operative period.

Duration of sensory block and duration of motor block were recorded. Intensity of post-operative pain was evaluated using VAS (Visual Analogue Scale), Grade 0 (no pain) to 100 (worst pain).

Analgesia was considered satisfactory if the score was 30 or less. If the score was more than 30, analgesia was judged unsatisfactory and rescue analgesic injection Diclofenac sodium (75mg) iv was administered. Time for first analgesic was noted. Post-operatively, heart rate, blood pressure, respiratory rate, oxygen saturation and VAS were recorded at 0 min, 30 min, 1 hr, 2 hr, 3 hr, 4 hr, 6 hr, 9 hr, 12 hr, and 15 hr.

In each patient, a chest x-ray was done 6 hrs post-operatively to rule out pneumothorax. Any neurological complication was noted.Both groups were compared for the duration of satisfactory analgesia from the time when the block was performed and the time for first administration of rescue analgesic.

Data were presented as mean values and mean ± S.D and analyzed using unpaired 't-test' with p value <0.05 considered statistically significant.

RESULTS :

After studying 50 cases, observation and results are summarized in tabulated form and ascribed below. Both groups comprised of 25 patients.

Table 1
Demographic Data

	Group A	Group B	P value	Inference
Sex (M/F)	17:8	18:7	>0.05	NS
Age (years)	33.52±8.82	35.76±11.05	>0.05	NS
Weight (kg)	59.32±4.98	60.92±6.11	>0.05	NS

There was no significant difference between the groups in terms of age, weight and male-female ratio.

Table 2
Onset of Anesthesia

Onset of Anesthesia	Group A	Group B	P value	Inference
Mean Sensory Block (min)	12.72±1.03	12.28±0.67	>0.05	NS
Mean Motor Block (min)	6.56±0.82	6.48±0.71	>0.05	NS

The mean time of onset of sensory and motor block was not significantly different in both groups.

Table 3
Duration of Analgesia and Anesthesia

Time (hrs)	Group A	Group B	P value	Inference
Mean duration of Motor Block	3.68±0.33	6.04±0.49	<0.05	S
Mean duration of Sensory Block	4.59±0.32	7.76±3.35	<0.05	S
Mean time of 1st analgesic	5.62±0.358	10.35±2.88	<0.05	S

Mean duration of motor block and sensory block are significantly longer in Group B than in Group A.

Mean time for first analgesic requirement for Group B is 10.35 ± 2.88 hrs and it is significantly longer than that in Group A 5.62 ± 0.358 hrs. P<0.05

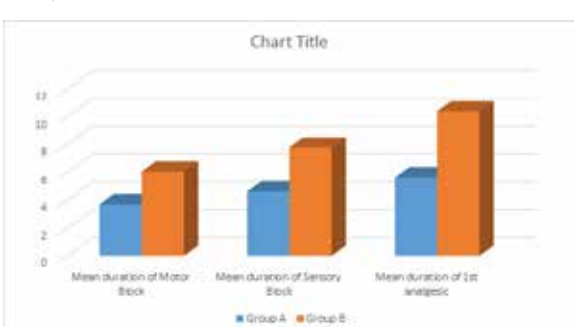

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Table 4
Intraoperative changes in respiratory rate, pulse rate and blood pressure

Time (mins)	Pulse Rate (per min)		Respiratory Rate (per min)		Blood Pressure (mmHg)			
	Group A	Group B	Group A	Group B	Group A		Group B	
					SBP	DBP	SBP	DBP
0	85.36±7.04	86.44±0.37	15.24±0.92	15.28±0.98	123.55±8.63	77.88±5.40	121.82±1.02	77.68±6.61
30	84.4±6.58	85.20±6.35	15.48±0.91	15.44±1.00	123.48±8.62	77±5.36	117.72±6.36	75.12±6.97
60	85.28±7.27	82.36±0.98	15.52±0.82	15.4±0.81	121.08±7.30	78.24±4.29	111.76±6.35	72.56±7.55
90	83.83±7.66	81.02±1.003	15.67±0.65	15.21±0.91	120.25±6.95	77.33±2.87	110.73±6.84	70±5.93
120	89.51±3.44	82.33±0.82	16±3.82	14.83±0.98	121±9.89	73±4.24	108.33±7.43	71±5.21
150	87.4±6.42	74±0.91	15.64±2.86	14±0.40	114±6.84	68±3.24	115±8.14	73±9.14

There was no significant difference in respiratory rate, pulse rate and blood pressure in the intraoperative period in both groups. This suggests that addition of Tramadol does not alter these parameters.

Table 5
Postoperative changes in respiratory rate, pulse rate and blood pressure

Time (mins)	Pulse Rate (per min)		Respiratory Rate (per min)		Blood Pressure (mmHg)			
	Group A	Group B	Group A	Group B	Group A		Group B	
					SBP	DBP	SBP	DBP
0	84.88±6.53	87.28±6.52	15.32±1.03	15.32±1.03	122.27±7.83	78.56±4.38	121.28±8.81	76.50±6.35
30	84.4±6.24	84.88±6.52	14.92±1.32	14.92±1.32	119.48±8.24	78.6±3.92	121.25±8.81	76.41±6.35
60	84.48±7.0	86.96±5.97	14.88±1.30	14.88±1.30	118.44±6.51	78.54±4.09	119.41±8.68	75.25±6.29
120	84.08±6.36	85.36±6.36	15.28±1.02	15.28±1.02	117.68±6.09	79.6±3.87	117.52±8.67	73.76±4.85
180	84.16±6.45	84.72±6.72	14.84±1.28	14.84±1.82	118.52±5.32	80.52±3.56	115.50±6.76	71.16±4.59
240	84.08±6.51	83.84±5.06	14.92±1.22	14.92±1.22	118.72±5.20	80.68±3.74	117.33±5.99	72.75±3.81
360	84.24±6.48	82±4.61	14.96±1.20	14.96±1.20	119.28±6.64	82.24±3.87	117.5±5.32	76.66±4.32
540	84.4±6.11	81.68±3.60	14.96±1.06	14.96±1.06	122.32±7.11	83.72±7.94	117.5±4.94	71.91±6.24
720	86.24±6.11	81.92±3.85	14.84±0.98	14.84±0.98	124.16±6.07	83.12±3.40	117±5.08	74.5±3.65
900	86.64±6.38	81.68±3.76	14.84±0.98	14.84±0.98	126.16±6.54	84.52±4.36	116.91±4.12	74.75±3.40

There was no significant difference in respiratory rate, pulse rate and blood pressure in the postoperative period in both groups. This suggests that addition of Tramadol does not alter these parameters.

DISCUSSION :

Supraclavicular blocks are performed at the level of the brachial plexus trunks. Here, almost the entire sensory, motor and sympathetic innervation of the upper extremity are carried in just three nerve structures (trunks), confined to a very small surface area. Consequently, typical features of the block include rapid onset, predictable and dense analgesia along with its high success rate.

Brachial plexus block via supraclavicular approach provides postoperative analgesia of short duration even when a long acting local anesthetic is used. Various adjuvant drugs like tramadol, clonidine, midazolam, neostigmine, hyaluronidase, sodium bicarbonate have been evaluated in conjunction with local anesthetics to prolong the period of analgesia with supraclavicular block.

Tramadol and local anesthetic agents have a synergistic action. Tramadol 100mg enhances both sensory and motor blockade of neuraxial and peripheral nerves after injection of local anesthetic solution. This is thought to be due to blockage of conduction of A delta and C fibers, increase in the potassium conductance in isolated neurons in vitro and intensification of conduction block achieved by local anesthetics.

The present study was performed to evaluate the efficiency of Tramadol when administered with a mixture of 1.5% lignocaine with adrenaline (1:200000) and 0.5% bupivacaine during supraclavicular brachial plexus blockade on postoperative analgesia in terms of first analgesic requirement. Onset and duration of sensory and motor blockade as well as perioperative hemodynamic changes and side effects were also studied.

It is crucial to select the appropriate dose of Tramadol that can provide adequate surgical anesthesia and post-operative analgesia with minimal side effects. Reviewing the various previous studies, 100mg of tramadol was chosen as optimal dose for our study.

Onset of Sensory and Motor Blockade

In our study, there was no significant difference was seen between the onset of motor and sensory blockade between the two groups. The mean duration of onset of motor and sensory blockade was **6.48±0.822** mins and **12.72±1.03** mins respectively for Group A and **6.48±0.71** mins and **12.28±0.67** mins respectively for Group B.

The onset of motor block was found to be faster than the onset of sensory block in the both groups. *Winnie et al*[24] observed this also, and attributed this to the somatotrophic arrangement of fibers in a nerve bundle at the level of

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the trunks in which motor fibers are located more peripherally sensory fibers. Hence a local anesthetic injected perineurally will begin to block motor fibers before it arrives at the centrally located sensory fibers.

Stephan Karpal et al[12] in their study mentioned that no difference in onset of sensory and motor blockade as seen in patient who received either mepivacaine with 100mg tramadol or with 2ml isotonic sodium chloride or mepivacaine with 2ml isotonic saline and 100mg tramadol intravenously.

Antonucci S et al[2] used clonidine(C), sufentanil(S) and tramadol(T), as adjuvants in axillary brachial plexus block. Onset time of anesthesia showed no significant difference between the three (S: 11±7 mins, C: 12±4 mins, T: 14±8 mins).

Our study suggests that addition of 100mg tramadol to local anesthetics in brachial plexus block does not hasten the onset of sensory and motor blockade.

Perioperative hemodynamic stability
The hemodynamic parameters – Heart Rate, Blood Pressure, SPo_2, Respiratory Rate during intra and postoperative period are depicted in tabular form.

In our study, there was no significant difference in the hemodynamics between the two groups perioperatively. Also during intraoperative period, hemodynamics remained stable in consistent manner, thereby reducing any anxiety related fluctuations in the vitals.

No patient in Group A had tachycardia and hypotension while one patient in Group B had tachycardia and two of them had hypotension. The reason for this complication can be blood loss from operative site after release of tourniquet. Hypotension and tachycardia were treated by colloids in three patients and blood in one patient.

Stephen Karpral et al[12] study also hemodynamics remained unchanged in all patients throughout study period irrespective of receiving tramadol added to mepivacaine or mepivacaine alone.

Broch O et al[4] did comparison of clonidine and tramadol added to prilocaine brachial plexus block and concluded that hemodynamic parameter remained stable in all patients.

The duration of surgery was comparable in both groups in our study.

The mean duration of surgery was **83.8 ± 22.32 mins** in Group A and 95.6 ± 19.59 mins in Group B.

Duration of Motor and Sensory Blockade
The mean duration of motor blockade was **3.68 ± 0.33 hrs in** Group A and **6.04 ± 0.49 hrs** in Group B. The duration of motor block was more in Group B (P<0.05).

The mean duration of sensory blockade was **7.76±3.35** hrs in group B and **4.59±0.32** hrs in group A. The duration of sensory block was longer in group B (P<0.05).

Results from our study are comparable to the findings of above studies.
According to *Stephen Karpal et al*[12] duration of sensory and motor block was significantly longer (299+84 and 259+76 mins). In mepivacaine plus tramadol group than mepivacaine plus isotonic saline group (194+35 and 181+24 mins) and mepivacaine plus isotonic saline group with tramadol given intravenously (187+35 and 176+16 mins). Addition of tramadol prolongs the duration of block without side effects.

Duration of Postoperative analgesia
Intensity of postoperative pain was evaluated using VAS-Visual Analogue Score (VAS, described by Aitkin) is easiest and most commonly used tool for assessment of pain.

The scale consists of a ruler with markings from 0-100. The patient is asked to grade their present perception of pain, from 0 (denoting no pain at all) to 100 (denoting worst possible pain they felt).

The duration of postoperative analgesia was assessed in terms of first analgesic requirement (VAS >30).

In our study, the time for first analgesic requirement in control group (GROUP A) was **5.62±0.35** hours compared to **10.35±2.88** hours in tramadol group (GROUP B) which means duration of postoperative analgesia was significantly more in group B (0.05).

Various studies evaluating the effects of addition of tramadol into brachial plexus block have been published, most of them reported prolongation of postoperative analgesia with tramadol, duration of which depends on dose of tramadol, type of local anesthetic used and technique of brachial plexus block performed.

The study done by *Robeaux S et al*[21] demonstrated that tramadol added to mepivacaine for brachial plexus anesthesia, extends the duration and improves the quality of postoperative analgesia in a dose dependent fashion with acceptable side effects. *Antonucci S*[2] compared clonidine, sufentanil and tramadol as adjuncts in axillary brachial plexus block with ropivacaine. Tramadol provided prolongation of anesthesia and postoperative analgesia with a quality of block similar to obtained with clonidine and sufentanil.

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