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STUDY ON THE EFFICACY OF TRAMADOL AS ADJUVANT TO BUPIVACAINE IN BRACHIAL PLEXUS BLOCK

Dr. ARUN KUMAR, MD
Associate Professor, Department of Anaesthesiology, Department of Critical Care Medicine

Dr. ABANIBHUSAN JENA, MD
Associate Professor – Designate, Department of Emergency Medicine & Trauma Care, Department of Critical Care Medicine

Dr. SURYASNATA,
AP, Department of Anaesthesiology

Dr. SNEHASISH,
SR, Department of Anaesthesiology

ABSTRACT

Background and objectives: Supraclavicular plexus block provides good alternative to General anaesthesia for upper limb surgeries with good postoperative analgesia. Various drugs have been tried as adjuncts to local anaesthetics for brachial plexus block to enhance the quality and duration of analgesia. The present study was undertaken to assess the effect of Tramadol added to brachial plexus block by supraclavicular approach for onset and duration of block and postoperative analgesia. **Methods:** A prospective, randomized, double blinded study was conducted on 100 ASA I or II adult patients undergoing upper limb surgeries under supraclavicular brachial plexus block. Patients were randomly divided into two groups. Patients in Group A (n= 50) were administered 28mL of 0.25% Bupivacaine + 2ml Normal saline and Group B (n = 50) were given 28mL of 0.25% Bupivacaine + 2ml Tramadol (2mg/kg). The onset time and duration of sensory and motor blockade were recorded. Haemodynamic variables (i.e., heart rate, systolic and diastolic blood pressure, oxygen saturation) and rescue analgesic requirements were recorded for 24 hrs postoperatively. **Results:** The onset of sensory and motor block was significantly faster in Group B compared to Group A (p<0.05). Rescue analgesic requirements were significantly less in Group B compared to Group A (p < 0.05). Haemodynamic variables did not differ between groups in the post-operative period. **Conclusion**: Thus Tramadol (2mg/kg) in combination with 28mL of Bupivacaine (0.25%) was found to be good agent for hastening the onset of sensory and motor block and improved postoperative analgesia when used in brachial plexus block without producing any adverse events.

Introduction:

“Man uses his arms and hand constantly. As a result, he exposes his arms and hands to injury constantly. Man also eats constantly. Man‟s stomach is never really empty. The combination of man‟s prehensibility and his unflagging appetite keeps a steady flow of patients with injured upper extremities and full stomachs streaming into hospital emergency rooms. This is why the brachial plexus is so frequently the anaesthesiologist‟s favorite group of nerves” - Classical Anaesthesia Files, David little, 19631.

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Brachial plexus block is an alternative technique to general anaesthesia for upper limb surgeries. They produce complete muscular relaxation, maintaining stable intraoperative hemodynamic condition and sympathetic block which reduces postoperative pain. Brachial plexus block is used today to provide anaesthesia for upper limb surgeries. There are four usual sites of approach:

1. Interscalene approach
2. Supraclavicular approach:
    a. Classic approach
    b. Plumb –bob technique
    c. Subclavian perivascular technique
3. Axillary approach
4. Infraclavicular approach

Among the four approaches, Supraclavicular brachial plexus block is a very popular mode of anaesthesia for various upper limb surgeries. This approach is attractive due to its effectiveness in terms of cost and performance, margin of safety, along with good postoperative analgesia. It also has the reputation of providing most complete and reliable anaesthesia for upper limb surgeries. The plexus is blocked at the level of trunk where it is most compact i.e. at the middle of brachial plexus, resulting in homogenous spread of anaesthetic throughout the plexus with a faster onset and complete block. Bupivacaine is one of the commonly used local anaesthetics as it has a longer duration of action varying from 3 to 8 hours.

However, it has limiting factors like delayed onset, patchy or incomplete analgesia. To minimize these drawbacks many drugs like neostigmine, opioids, hyaluronidase, midazolam, clonidine etc., have been added to local anaesthetics to improve the quality and duration of action and postoperative analgesia. A variety of opioids have been studied for brachial plexus blockade including tramadol. Tramadol is a synthetic 4-phenylpiperidine analog of codeine has a unique mode of action. First, it stimulates the receptor and to lesser extent and -opioids receptors. Then by nonopioid mechanism it also activates spinal inhibition of pain by decreasing the reuptake of norepinephrine and serotonin from the nerve endings and potentiates the effect of local anaesthetics when mixed together in peripheral regional nerve block.

It has less respiratory depressant effect due to weak receptor affinity. The present study is being undertaken to evaluate the onset time, duration and postoperative analgesic efficacy of bupivacaine and tramadol for brachial plexus block by supraclavicular approach.

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AIM OF THE STUDY

To evaluate the effects of adding tramadol (2mg/kg) as an adjuvant to bupivacaine (0.25%) in 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
- Untoward side effects
- Hemodynamic variables
- Number of rescue analgesics in the postoperative 24hours

Technique Of Blockade – Supraclavicular Subclavian Perivascular Approach To Brachial Plexus

Anatomical Land marks: The three trunks are clustered vertically over the first rib cephaloposterior to the subclavian artery. Neurovascular bundle lies inferior to the clavicle at above its mid point.The essential landmarks to be identified are:

1. Cricoid cartilage
2. Interscalene groove
3. Clavicle midpoint
4. Subclavian artery

Procedure: Supraclavicular Block was done by Subclavian Perivascular Approach in all patients. **Position:** Supine position with the head turned to the opposite side to be blocked. The arm is pushed down to depress the clavicle.

The posterior border of sternocleidomastoid is felt, by asking the patient to raise the head while keeping the head turned to opposite side. The interscalene groove should be located behind the midpoint of the posterior border of the muscle. The anterior and middle scalene muscles can be made prominent by asking the patient to inspire vigorously. Approximately 1 cm above the midpoint of the clavicle the pulsation of the subclavian artery can be felt in the interscalene groove while standing on the side of the patient. On the right side interscalene groove is palpated with the left index finger and the needle is inserted with the right hand. Subclavian artery is guarded with thumb. After aseptic measures and intradermal wheal raised with local infiltrations of 1 ml of 2% Lignocaine intradermally in the interscalene groove 1 to 1.5 cm above the clavicle. To avoid intra vascular injection aspiration done every 3-5 ml of the drug injected. The solution should flow without resistance. High resistance or pain on injection may indicate intraneural injection and the needle must be repositioned.

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Volume of local anaesthetic (either 1% lignocaine or 0.25% Bupivacaine) that can be used is 25-40 ml depending on the weight of the patients. When large volumes are used the sheath may be felt to distend during injection and is easily distinguished from the subcutaneous swelling of an extra fascial injection. To encourage the spread proximally, digital pressure distal to the needle point may be used and digital pressure proximal to needle insertion point may help to encourage distal spread.

MATERIALS AND METHODS:

After obtaining institutional ethical committee clearance and written informed consent from the patients, 100 patients of age group 18 years and above with ASA I and ASA II grade of either sex undergoing upper limb surgery under supraclavicular brachial plexus block, during the study period at S. C. B. Medical College & Hospital, Cuttack was included in the study.

Place Of Study: SCB Medical College and Hospital, Cuttack

Period Of Study: 1 year (October 2020- September 2021)

Study Design: Prospective Randomised Controlled Study

Sample Size: One Hundred (N=100)

Method of Randomisation: Patients were randomised by sealed envelope method into 2 study groups.

Group A: 50 patients received 28ml of 0.25 % bupivacaine + 2ml normal saline Group B: 50 patients received 28ml of 0.25% bupivacaine + 2ml tramadol (2mg/kg). **Inclusion criteria**

• ASA Status I and II

• Age 18 years and above

• Weight $\geq$ 40 kg

• Patients undergoing surgeries in distal end of arm, forearm and hand

Exclusion criteria

- Patient refusal
- Local infections at the site of puncture for block / Sepsis Known allergy for the drugs to be studied.
- Coagulation abnormalities
- H/o significant systemic disorders
- Pregnancy/lactating women
- Chronic analgesic therapy (other than NSAIDS)
- Peripheral neuropathy

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- BMI >30
- Not fulfilling inclusion criteria

The information collected in our study Group A and Group B were recorded in a Master Chart. Data analysis was done with the help of computer using SPSS. For statistical analysis students t test was used for comparison between the groups. Using this range, frequencies, percentages, means, standard deviations, chi square and „*p*" values were calculated. A „*p*" value less than 0.05 was considered statistically significant.

Table 1: Demographic profile of the patients

Sl. No.	Demographic profile	Control Group(A)	Tramadol Group (B)
1	No. of patients	50	50
2	Average age (years)	38.87 ± 13.544	36.4 ±11.44
3	Weight (in Kgs)	66.70 ± 5.914	66.9 ± 5.026
4	Gender ratio (Male : Female)	27:23	40:10

The above table shows that the average age was 38.87 ± 13.544 years in group A and 36.40 ± 11.440 years in group B. Youngest patient in our study group was 19 yrs and oldest was 72 years. The average weights of the patients were 66.70 ± 5.914 kgs in group A and 66.90 ± 5.026 kgs in group B respectively. Majority of the patients in both groups were males. There was no significant difference in age, weight and sex distribution.

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Table: 2
Mean Age of the patients (years)

Sl.no	Age	Group		Statistical inference
		A (n=50)	B (n=50)	
1	Below 30yrs	18 (36.7%)	18 (36.7%)	X2=3.58 Df=3 p = .302>0.05 Not Significant
2	31 to 40yrs	13 (26.7%)	18 (36.7%)	
3	41 to 50yrs	12 (23.3%)	03 (6.7%)	
4	51yrs & above	07 (13.3%)	11 (20%)	

Table : 3
Sex distribution

Sex	Group A		Group B	
	No.	%	No.	%
Male	27	56.7	40	80
Female	23	43.3	10	20
Total	50	100	50	100
„p"	0.0959>0.05 Not significant			

Table : 4
Mean Weight

Sl. no	Weight	Mean	S.D	Statistical inference
1	A (n=50)	66.70	5.914	T= -.141 .888>0.05
2	B (n=50)	66.90	5.026	

Table 5: Surgical profile of the patients:

Sl.No.	Surgical Profile	A	B
1	ASA Status (II:I)	42:08	42:08
2	Duration of surgery (in hours)	1.89 ± 0.484	1.77 + 0.388

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Table 6: ASA Status

ASA Status	Group A		Group B	
	No	%	No	%
I	42	83.3	42	83.3
II	8	16.7	8	16.7
Total	50	100	50	100
„*p*" 1>0.05 not significant				

Table 7:Duration of surgery in hours

Duration of surgery in hours	Mean	S.D	Statistical inference
A (n=50)	1.89	.484	T=1.089 .281>0.05 Not Significant
B (n=50)	1.77	.388	

ASA Status, type and duration of surgery were similar in both groups. The mean duration of surgery was 1.89 + 0.484 hours in group A compared to 1.77 ± 0.388 hours in B group. There was no clinical or statistical significance.

Table 8: Onset of sensory block between study groups:

Onset of Sensory block in Minutes	Mean	S.D	Statistical inference
A(n=50)	17.20	2.140	T =13.854 .000<0.05 Significant
B (n=50)	10.07	1.837	

The mean time for onset of sensory block in Group A was 17.20 ± 2.140 and in Group B was10.07 ± 1.837. The statistical analysis by students „t" test showed that the time for onset of sensory block in group B was significantly faster when compared to Group A (p <0.05) as shown in Table 8.

Table: 9

Onset of motor block between study groups:

Onset of motor block in minutes	Mean	S.D	Statistical inference
A (n=50)	9.10	1.373	T=10.338 .000<0.05 Significant
B (n=50)	5.83	1.053	

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The mean time for onset of motor block in Group A was 9.10 ± 1.373minutes and in Group B was 5.83 ± 1.053minutes as shown in table 9. The statistical analysis by students „t" test showed that the time for onset of motor block in group B was significantly faster when compared to Group A (*p* <0.05)

Table: 10

Duration of sensory block in hours:

Duration of sensory block in hours.	Mean	S.D	Statistical inference
A (n=50)	3.18	.524	T=-17.392 .000<0.05 Significant
B (n=50)	5.88	.669	

The duration of sensory blockade in Group A was 3.18 ± 0.524 hours and in Group B, was 5.88 ± 0.669 hours as shown table 10. The statistical analysis by students „t" test showed that the time for duration of sensory block in group B was significantly longer when compared to Group A (.000<0.05)

Table: 11

Duration of motor block in hours:

Duration of motor block in hours.	Mean	S.D	Statistical inference
A (n=50)	2.34	.362	T=-16.916 .000<0.05 Significant
B (n=50)	4.65	.654	

The duration of motor blockade in Group A was 2.34 ± 0.362 hours and in Group B, was 4.65 ± 0.654 hours as shown table 11. The statistical analysis by students „t" test showed that the time for duration of motor blockade in group B was significantly longer when compared to Group A (*P* < 0.05).

Table: 12

Duration of analgesia in hours:

Duration of analgesia in hours	Mean	S.D	Statistical inference
A (n=50)	3.42	.283	T=-6.849 .000<0.05 Significant
B (n=50)	7.06	2.894	

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The duration of analgesia in Group A was 3.42 ± 0.283 hours and in Group B, was 7.06 ± 2.894 hours as shown table 12. The statistical analysis by students „t" test showed that the time for duration of analgesia in group B was significantly longer when compared to Group A ($p < 0.05$).

Table: 13: Number of rescue analgesia in 24hours Post operative period:

Number of rescue analgesics in 24hours Post operative period	Mean	S.D	Statistical inference
A (n=50)	2.43	.568	T=9.956 .000<0.05 Significant
B (n=50)	1.13	.434	

In Group A patients required 2.43± 0.568 rescue analgesic dosage and in group B patients required only 1.13± 0.434 rescue analgesic doses in postoperative 24hours as shown in table 13. This difference in number of rescue analgesic doses required by patients of both groups is statistically significant ($p < 0.05$).

Hemodynamic variables: Pulse rate ,systolic blood pressure, diastolic blood pressure and oxygen saturation were recorded at 0min, 2 mins,5mins,10mins, 15mins,30 mins,1 hour, 2 hours, 3 hours,6 hours,12 hours and 24 hours.

Pulse rate (beats/min)

There was no significant difference in pulse rate between the two groups as shown in table 14 ($p >0.05$). None of the patients in both group developed bradycardia.

The mean systolic blood pressure between the two groups as shown in table 15 was comparable ($p > 0.05$).None of the patients in both group developed hypotension.

There was no significant difference in **Diastolic Blood pressure** between the two groups as shown in table 16 ($p > 0.05$)

SpO2: The statistical analysis by students "t" test showed that there was no significant difference in oxygen saturation between the two groups as shown in table 17 ($p >0.05$)

Comparison of side effects:

None of the patients in both the groups developed any complications shown in table 18.

Table : 18

Side effects	Group	Group B
Bradycardia	Nil	Nil
Hypotension	Nil	Nil
Nausea	Nil	Nil
Vomiting	Nil	Nil

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Table: 14. Pulse Rate

Pulse	Study group	Mean	S.D	Statistical inference
0minutes	A (n=50)	83.73	12.868	T=.152,0.880>0.05
	B (n=50)	83.23	12.607	Not Significant
2minutes	A (n=50)	82.10	13.116	T=.000, 1.000>0.05
	B (n=50)	82.10	12.115	Not Significant
5minutes	A (n=50)	80.53	12.294	T=.129, 0.898>0.05
	B (n=50)	80.13	11.685	Not Significant
10minutes	A (n=50)	79.90	12.307	T=.217, 0.829>0.05
	B (n=50)	79.23	11.482	Not Significant
15minutes	A (n=50)	79.20	11.883	T=.546, 0.587>0.05
	B (n=50)	77.57	11.288	Not Significant
30minutes	A (n=50)	78.60	11.254	T=.035, 0.972>0.05
	B (n=50)	78.50	10.919	Not Significant
1hour	A (n=50)	78.00	11.151	T=.368, 0.714>0.05
	B (n=50)	76.97	10.604	Not Significant
2hour	A (n=50)	77.33	11.056	T=.312, 0.756>0.05
	B (n=50)	76.47	10.421	Not Significant
3hours	A (n=50)	75.27	10.225	T=-.203, 0.839>0.05
	B (n=50)	75.80	10.077	Not Significant
6hours	A (n=50)	79.47	11.301	T=.289, 0.774>0.05
	B (n=50)	78.70	9.136	Not Significant
12hours	A (n=50)	79.33	10.337	T=.027, 0.978>0.05
	B (n=50)	79.27	8.662	Not Significant
	A			

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Table : 15 Systolic blood pressure (mmHg)

Time of Assessment	Groups	Mean	S.D	Statistical inference
0 mins	A (n=50)	122.67	9.444	T=-.647 .520>0.05 Not Significant
	B (n=50)	124.20	8.919	
2 mins	A (n=50)	124.00	8.550	T=-.089 .930>0.05 Not Significant
	B (n=50)	124.20	8.919	
5 mins	A (n=50)	123.87	8.629	T=-.030 .977>0.05 Not Significant
	B (n=50)	123.93	8.843	
10 mins	A (n=50)	123.80	8.588	T=.569 .571>0.05 Not Significant
	B (n=50)	122.53	8.645	
15 mins	A (n=50)	122.80	9.182	T=-.029 .977>0.05 Not Significant
	B (n=50)	122.87	8.593	
30 mins	A (n=50)	121.80	8.684	T=-.285 .777>0.05 Not Significant
	B (n=50)	122.47	9.449	
1 hr	A (n=50)	121.27	8.686	T=-.908 .367>0.05 Not Significant
	B (n=50)	123.33	8.934	
2 hr	A (n=50)	121.20	8.704	T=-2.002 .052>0.05 Not Significant
	B (n=50)	125.53	8.046	
3 hr	A (n=50)	121.07	8.610	T=-2.431 .081>0.05 Not Significant
	B (n=50)	126.20	7.725	
6hr	A (n=50)	120.20	7.618	T=-1.152 .254>0.05 Not Significant
	B (n=50)	122.40	7.171	
12hr	A (n=50)	119.73	7.196	T=-1.175 .245>0.05 Not Significant
	B (n=50)	121.87	6.867	
24hr	A (n=50)	119.67	7.184	T=-1.171 .246>0.05 Not Significant
	B (n=50)	121.73	6.470	

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Table 16: Diastolic Blood Pressure (mm Hg)

Time of Assessment	Groups	Mean	S.D	Statistical inference
0 mins	A (n=50)	75.33	6.288	T=-.182 .856>0.05 Not Significant
	B (n=50)	75.60	4.994	
2 mins	A (n=50)	75.33	6.288	T=-.182 .856>0.05 Not Significant
	B (n=50)	75.60	4.994	
5 mins	A (n=50)	75.33	6.288	T=-.137 .892>0.05 Not Significant
	B (n=50)	75.53	4.946	
10 mins	A (n=50)	74.87	5.794	T=-.340 .735>0.05 Not Significant
	B (n=50)	75.33	4.795	
15 mins	A (n=50)	74.60	5.537	T=.490 .626>0.05 Not Significant
	B (n=50)	73.93	4.996	
30 mins	A (n=50)	73.87	5.144	T=.674 .503>0.05 Not Significant
	B (n=50)	73.00	4.807	
1 hr	A (n=50)	73.33	5.101	T=.899 .372>0.05 Not Significant
	B (n=50)	72.20	4.649	
2 hrs	A (n=50)	72.93	4.891	T=1.142 .258>0.05 Not Significant
	B (n=50)	71.53	4.599	
3 hrs	A (n=50)	72.73	4.968	T=1.381 .172>0.05 Not Significant
	B (n=50)	71.00	4.749	
6 hrs	A (n=50)	75.20	4.944	T=.211 .834>0.05 Not Significant
	B (n=50)	74.93	4.863	
12 hrs	A (n=50)	74.87	5.722	T=-.288 .775>0.05 Not Significant
	B (n=50)	75.27	5.024	
24 hrs	A (n=50)	75.80	5.616	T=-.149 .882>0.05 Not Significant
	B (n=50)	76.00	4.727	

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Table 17: Changes in SpO_2 Levels

Time of Assessment	Groups	Mean	S.D	Statistical inference
0 mins	A (n=50)	99.73	.521	T=.484 .630>0.05 Not Significant
	B (n=50)	99.67	.547	
2 mins	A (n=50)	99.73	.521	T=.484 .630>0.05 Not Significant
	B (n=50)	99.67	.547	
5 mins	A (n=50)	99.70	.535	T=.239 .812>0.05 Not Significant
	B (n=50)	99.67	.547	
10 mins	A (n=50)	99.37	.556	T=-.209 .835>0.05 Not Significant
	B (n=50)	99.40	.675	
15 mins	A (n=50)	99.30	.596	T=1.706 .093>0.05 Not Significant
	B (n=50)	99.03	.615	
30 mins	A (n=50)	99.20	.610	T=1.257 .082>0.05 Not Significant
	B (n=50)	98.83	.648	
1 hour	A (n=50)	99.03	.615	T=1.227 .225>0.05 Not Significant
	B (n=50)	98.83	.648	
2 hours	A (n=50)	99.03	.669	T=1.412 .091>0.05 Not Significant
	B (n=50)	98.63	.615	
3 hours	A (n=50)	99.10	.548	T=1.288 .203>0.05 Not Significant
	B (n=50)	98.93	.450	
6 hours	A (n=50)	99.10	.548	T=1.288 .203>0.05 Not Significant
	B (n=50)	98.93	.450	
12 hours	A (n=50)	99.03	.669	T=1.412 .091>0.05 Not Significant
	B (n=50)	98.63	.615	
24 hours	A (n=50)	99.30	.596	T=1.904
	B (n=50)	98.83	.648	.051>0.05 Not Significant

Discussion:

The supraclavicular brachial plexus approach is a very popular mode of anaesthesia, in which a small volume of solution can be delivered at a point where three trunks are compactly arranged, 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. The nerve stimulator can be used to aid the

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location of the brachial plexus and plain bupivacaine used by this method has been claimed to produce the block as long as 3 - 8 hours. Practically the same result could not be produced in series of study with sole bupivacaine. To extend the analgesia beyond the operation rooms, various local anaesthetic action like continuous infusion of local anaesthetic via in dwelling catheters, use of 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. A variety of opioids have been studied for brachial plexus blockade including tramadol hydrochloride.

Tramadol is known to produce antinociception and to enhance the effect of local anaesthetic. Tramadol produces this effect by its dual mechanism of action. Firstly it stimulates receptor and to lesser extent and - opioid receptors. Secondly it activates spinal inhibition of pain by decreasing the reuptake of norepinephrine and serotonin (non opioid mechanism) in peripheral nerve blocks. Several studies have demonstrated the advantage of using tramadol hydrochloride through various routes for analgesia.

Hence an attempt has been made to assess the efficacy of tramadol (2mg/kg) as an adjuvant to bupivacaine (0.25%) in brachial plexus block (supraclavicular approach) in terms of onset time, duration of analgesia, hemodynamic variables and rescue analgesic requirements in the first 24 hours.

A volume of 30ml of local anaesthetic agent was taken as this volume was associated with a more complete spread for brachial plexus block as found by Winnie and colleagues[36]. The particular dose of Tramadol 2mg/kg (100mg) was selected after previous studies like Kapral et al[24], Antonucci et al[19], Renu Wakhlo et al[18], Geze et al[20] and Siddiqui AS et al[28] used the same dosage in peripheral nerve block without any significant adverse effects. A total of 100 patients within the age group of 19-72 were included in the study, 50 in each Group A and Group B.

Onset of Action: In our study we found that the onset of sensory and motor block were significantly faster in patients who received a combination of tramadol and bupivacaine. Onset of motor block (group B, 5.83 ± 1.053 min; group A, 9.10 ± 1.373 min). Onset of sensory block (group B 10.07± 1.837 min; group A 17.20 ± 2.140 min).

This could be due to a local direct action of Tramadol and its synergistic action with that of local anaesthetics. The onset of motor block was significantly faster than the onset of sensory block in both groups, this can be explained by „Core and Mantle" concept of Winnie et al 1977[2], He observed and attributed this to the somatotrophic arrangement of fibres in a nerve bundle at the level of the trunks in which motor fibres are located more peripherally form the mantle and are blocked earlier than the sensory fibres at the core. Hence a local anaesthetic injected perineurally will begin to block the motor fibres before it arrives at the centrally located sensory fibres.

Duration of Motor and Sensory Block: In our study mean duration of motor block was prolonged when tramadol was added to bupivacaine. (Group B, 4.65 ± 0.654 hours; Group A, 2.34 ± 0.362 hours). In our study, the mean duration of sensory block was

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significantly higher (P < 0.05) in group B than in group A. (Group A, 5.88 ± 0.669 hours; Group B, 3.18 ± 0.524 hours).

Our results showed that sensory block tended to last longer as compared to motor block which agrees with the observation by de Jong et al[37]. These authors explained that large fibres require a higher concentration of local anaesthetic than small fibres. The minimal effective concentration of local anaesthetic for large (motor) fibres is greater than for small (sensory) fibres.Thus, motor function returns before pain perception and duration of motor block is shorter than the sensory block.

Duration of Analgesia: In our study duration of analgesia (from onset of blockade to requirement of first supplement analgesic) was significantly higher in Tramadol Group B (7.06 ± 2.894) compared to Group A (3.42 ± 0.283). These results are comparable with the study of Suman Chattopadhyay et al[17].

Tramadol as analgesic adjuvant: Various studies of Tramadol used in peripheral nerve block showed that Tramadol with Bupivacaine improves analgesic characteristics compared to Bupivacaine alone when administered for various peripheral nerve blocks.

Renu Wakhol et al[18] showed addition of (100 mg) 2 mg/kg of Tramadol to local anesthetic was found to be good agent for hastening the onset and prolonging sensory and motor block. Sebastein Robaux et al[22] found that addition of tramadol to local anaesthetic agents improved the onset and duration of motor blockade. Antonucci S et al[19] found that Tramadol 100mg useful alternative, as adjuvant in peripheral block with lower incidence of side effects.

W. Kunapis et al[27] showed that adding Tramadol to Bupivacaine for brachial plexus block provides faster onset and longer duration of analgesia, improves the quality of analgesia. Siddiqui AK et al[28] studied addition of Tramadol 1mg/kg (50 mg) and (100mg) 2 mg/kg. Suggested that Tramadol 100mg is beneficial additive to lignocaine for IVRA since it shortened the onset of sensory block, enhanced the tourniquet tolerance and improved the perioperative analgesia.

All the studies are comparable with our results.

Tramadol has a local anaesthetic effect on peripheral nerves as this could provide potentially a synergistic effect in continuous infusion as an additive to local anaesthetic agent has been studied by J.Balavenkatasubramanian[34].

Rescue Analgesia: In our study, the number of patients who required rescue analgesia was also significantly lower in patients in Group B. Similar observation was made in the above mentioned study by Suman Chattopadhyay et al[17]. The prolonged analgesia in Group B could be due to local anaesthetic type effect of Tramadol on peripheral nerves as demonstrated by Yu-Chan Tsai et al[31].

Tramadol, an analgesic with peripheral effects similar to clonidine, moderately increases sensory block duration when compared with placebo or systemic control as mentioned in study by Joseph M. Neal et al38. Adding small doses of opioids to local

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anaesthetic solutions for peripheral blocks have resulted in improvement in the onset time, quality and duration of nerve block.

Side effects: No significant side effects like respiratory depression, pneumothorax, signs and symptoms of local anaesthetic toxicity or neurological sequale were observed in any of the two groups. The lack of significant side effects like respiratory depression and sedation make Tramadol as an adjuvant for supraclavicular brachial plexus block.

Haemodynamic parameters: In this study there was no significant change in the haemodynamic parameters between the groups. This was consistent with the observation by Suman Chattopadhyay et al[17].

In conclusion, Tramadol 100mg (2 mg/kg) when added to 28ml of Bupivacaine 0.25% for supraclavicular brachial plexus block speeds the onset of sensory and motor blocks ($P < 0.05$). The combination produces improved analgesia, resulting in a prolonged effect and reduced requirements for rescue analgesics.

We conducted this study at SCB Medical College and Hospital in 100 patients of both sex in age group of 19 to 72 years belonging to ASA I and II and their weight ranging in between 55 to 80 kg posted for various upper limb surgeries under subclavian perivascular approach of brachial plexus block.

The patients in group A received 28ml of 0.25% Bupivacaine and 2 ml Normal saline. In group B received 28ml of 0.25% Bupivacaine and 2ml (2mg/kg) Tramadol.

Parameters observed were time of onset of sensory block and motor block, duration of motor blockade, and sensory blockade, duration of analgesia, sedation score and side effects.

This study shows that

Addition of tramadol to bupivacaine, when compared to bupivacaine alone, shows

1. Earlier the onset of motor and sensory blockade
2. Increases the duration of motor and sensory blockade
3. Significantly prolongs the duration of analgesia
4. Requirement of rescue analgesic in postoperative period 24 hours is less
5. Does not cause significant haemodynamic changes, respiratory depression, sedation or other adverse effects.

From our study we conclude that the addition of the tramadol 2mg/kg to 0.25% bupivacaine solution in brachial plexus block shows early onset of sensory and motor blockade and prolongs the duration of analgesia when compared to Bupivacaine alone. There are no significant side effects like respiratory depression and sedation. Hence tramadol may be considered as a useful adjuvant for bupivacaine when used for brachial plexus block.

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Bibliography

1. Brown DL. Atlas of Regional anaesthesia. In LocalAnaesthetics and Regional
2. Anaesthesia Equipment. 2nd Ed. 3rd ed., 2006: chapter 3:27 Philadelphia: WB Saunders; 2.
3. Winnie AP. Plexus anesthesia vol.1, 1st ed. 1984. p.83.
4. Harold Ellis, Stanley Feldman. Anatomy for anaesthetists 2004:8:153 -180
5. William F. Ganong, Review of Medical Physiology, 2003: 21:51 -64.
6. Ronald D.Miller.Pharmacology of Local Anaesthetics 2005:6(1):579- 582.
7. Pither CE. The use of peripheral nerve stimulators for regional anaesthetic. A review of experimental characteristics, techniques and clinical application. Reg Anaesth 1985; 10:49-58.
8. Hadzic A. Nerve stimulators used for peripheral nerve blocks vary in their electrical characteristics. Anesthesiology 2003; 98: 969-74.
9. Goodman Gillman A. Local Anaesthetics in: The Pharmacological Basis of
10. Ronald D Miller. Pharmacology of local anaesthetics Therapeutics, 10th Edition, United States of America, McGraw Hill, 2001. 2005:6(1):592.
11. Stoelting RK. Local Anaesthetics in: Pharmacology & Physiology in Anaesthetic Practice, 3rd Edition, Philadelphia, New York, Lippincott Raven, 1999.
12. Ronald D Miller. Regional anaesthesia in children.2005:6(3):1728 13. Miller RD, editor. Anaesthesia 6th ed, Philadelphia: ChurchillLivingstone, 2005 .p.379-425.
13. Goodman and Gilman"s the pharmacological basis of therapeutics, Opioid analgesics. 10th ed. NewYork : McGraw Hill; 2001 .p.337-619.
14. Stoelting RK, editor. Pharmacology and physiology in Anaesthesia practice.
15. 3rd ed, Philadelphia : Lippincott-Raven; 1999 .p.77-112. 79
16. Satoskar .Pharmacology and pharmacotherapeutics. 18th ed. Mumbai: Popular Prakashan Pvt Ltd; 2003 .p.138-155.
17. Suman Chattopadhyay LG et al. Tramadol as anAdjuvant for Brachial Plexus Block. J Anaesth Clin Pharmacol 2007; 23(2): 187-189
18. Renu Wakhlo et al. Supraclavicular Plexus Block: Effect ofAdding Tramadol or
19. Butorphanol as an Adjuncts to Local Anaesthetic on Motor and Sensory Block and Duration of Post-operative Analgesia. J Anaesth Clin Pharma 2009; 25(1): 17-20.
20. Antonucci S et al. Adjuvants in the axillary brachial plexus blockade comparison between clonidine, sufentanil and tramadol. Minerva Anesthesiology 2001 Jan-Feb; 67(1-2):23-7.
21. Sukran Geze et al. Comparison of LocalAnaesthetic Mixtures with Tramadol or Fentanyl for Axillary Plexus Block in Orthopaedic Upper Extremity Surgery. Eur J Gen Med 2012; 9(2):118-123.
22. Shrestha BR 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.
23. Sebastien Robaux et al. Tramadol Added to 1.5% Mepivacaine for Axillary Brachial Plexus Block Improves PostoperativeAnalgesia Dose-Dependently. Anesth Analg 2004; 98: 172-77.
24. Kaabachi O et al. Tramadol as an adjuvant to Lidocaine for Axillary brachial plexus block. Anaesth Analg 2009; 108(1):367-70.

ISSN：1671-5497
E-Publication Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/BAQEY

25. Stephan Kapral et al. Tramadol Added to Mepivacaine Prolongs the Duration of an Axillary Brachial Plexus Blockade. Anaesth Analg 1999; 88:853–6.
26. Alemanno F et al. Tramadol and 0.5% levobupivacaine for singke shot interscalene block: effects on postoperative analgesia in patients undergoing shoulder arthropalsty. Minerva Anestesiologica March 2012:vol.78 – No.3:291-296.
27. Ravi Madhusudhana et al. Supraclavicular brachial plexus block with 0.75% Ropivacaine and with additives tramadol, fentanyl – a comparative pilot study. Int J Biol Med Res.2011;2(4):1061-1063.
28. W. Kunapis et al. Brachial Plexus Block with Tramadol and Bupivacaine in Dogs Undergoing Orthopedic Surgery. Vet Sci Ann Con 2010.
29. Ahsan K. Siddiqui et al. Tramadol as an adjuvant to intravenous regional anesthesia with lignocaine. Saudi Med J 2008; vol.29(8):1151-1155.
30. Ahed Zeidan et al. Intraarticular Tramadol-Bupivacaine Combination Prolongs the Duration of Postoperative Analgesia after Outpatient Arthroscopic Knee Surgery. Anesth Analg 2008; 107: 292-9.
31. Joseph M. Neal. Brachial plexus anaesthesia: Essentials of our current understanding.
32. Reg Anaesthesia & Pain Medicine 2002 July-August; 27(4):402- 428.
33. Yu-Chuan Tsai et al. Direct Tramadol Application on Sciatic Nerve Inhibits Spinal Somatosensory Evoked Potentials in Rats. Anesth Analg 2001; 92:1547- 51.
34. Kargi E et al. Tramadol as a local anaesthetic in tendon repair surgery of the hand. J Int Med Res 2008-09;36(5):97-18.
35. Shrestha SK et al. Caudal Bupivacaine vs Bupivacaine plus Tramadol in post operative Analgesia in Children. J Nepal Health Res Counc 2010 oct;8(17):99- 102.
36. J Balavenkatasubramanian. Continuous Peripheral Nerve Block: the Future of Regional Anaesthesia? Indian Journal of Anaesthesia 2008; 52 (5):506-516.
37. Carlo D. Franco, M.D., and Zairo E.G. Vieira, M.D. 1,001 Subclavian Perivascular Brachial Plexus Blocks: Success With a Nerve Stimulator. Regional Anaesthesia and Pain Medicine, Vol 25, No 1 (January–February), 2000: pp 41–46.
38. Winnie AP. The subclavian perivascular technique of brachial plexus anesthesia. *Anesthesiology* 1964; 25:353-363.
39. De Jong RH. Physiological mechanism of peripheral nerve block by local anaesthetics.
40. Anesthesiology 1963; 24:684-727.