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A Comparative Study of Tramadol vs Butorphanol as an Adjuvant with Local Anaesthetic in Supraclavicular Brachial Plexus Block in Upper Limb Surgeries

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Abstract

Brachial plexus block is a versatile and reliable regional anaesthesia technique. It is a block of roots, divisions and cords first performed by Halsted in 1884. It provides a useful alternative to general anaesthesia for upper limb surgery by being safe, decreasing the cost of anaesthetic agents, decrease operation theatre pollution and prolonged post-operative pain relief. Objectives: To study comparative effect of adding tramadol and butorphanol as an adjuvant with local anaesthetic (bupivacaine + xyloadrenaline) in supraclavicular brachial plexus block in upper limb surgeries.

Methods and Material: 60 patients were divided into two groups:

Group A: inj. bupivacaine 0.5% (15ml)+inj xyloadrenaline (15ml) +inj tramadol(100mg) 2ml+inj ns 3 ml.

Group B: inj. bupivacaine 0.5% (15ml)+inj xyloadrenaline (15)ml +inj butorphanol (1mg)1ml + inj ns 4ml. Assessment of onset of sensory and motor blockade, surgical procedure and duration of surgery. Perioperative complications were recorded and managed accordingly.

Results: The onset of sensory block was rapid with Tramadol (4.2 min) as compared to Butorphanol (18.83min). The onset of motor blockade was faster with Tramadol (7.7min) as compared to Butorphanol (24.13min). Tramadol has longer duration of sensory (634.66 min) and motor (458.33 min) blockade as compared with butorphanol group (282.03min) and (350.16min) respectively ($p<0.05$). Duration of surgery and VAS Score was also similar in both groups and statistically not significant.

Conclusion: Tramadol greatly reduce the onset time for sensory and motor block as well prolong the sensory and motor block,while Butorphanol has minimal effect on onset and duration of block but it provide post op analgesia.

Keywords: Supraclavicular brachial plexus block; Tramadol; Butorphanol; Upper limb surgeries.

Introduction

The recent emergence of pain management and increasing importance of outpatient (ambulatory) surgery in anaesthetic practice have further increased interest in peripheral nerve blocks. Peripheral nerve block forms an important part of regional anaesthesia techniques as it provides a safe, low cost method with advantage of early ambulation and prolonged post operative pain relief.[1,2,3]

Brachial plexus block is a versatile and reliable regional anaesthesia technique. It is a block of roots, divisions and cords first performed by Halsted in

1884. It provides a useful alternative to general anaesthesia for upper limb surgery by being safe, decreasing the cost of anaesthetic agents, decrease operation theatre pollution and with an advantage of prolonged post-operative pain relief. The sympathetic block decreases post-operative pain, vasospasm and oedema. There are different ways to block the brachial plexus.

The supraclavicular approach to brachial plexus blockade was introduced in clinical practice in Germany by Kulenkampff in 1911. The supraclavicular brachial plexus blockade (SCB) provides anaesthesia of the entire upper extremity in the most consistent, time efficient manner of many brachial plexus technique. It is performed at the trunk level where plexus is presented most compactly.

The Brachial plexus block also performed by other routes like axillary, infraclavicular, interscalene route.

It is always be the interest of an anaesthetists to increase the quality of local anesthetics. The local anaesthesia prolongs the duration of surgical anaesthesia and analgesia With advent of opioid receptors, variety of opioid agents is used for post operative analgesia in brachial plexus block.[3]

Butorphanol is a synthetically derived opioid antagonist acts as an analgesic of the phenanthrene series. It exhibits partial agonist and antagonist activity at the μ(mu) opioid receptor and agonist activity at k(kappa) opioid receptors. Stimulation of these receptors on central nervous system neurons cause an intracellular inhibition of adenylyl cyclase, closing the influx membrane calcium channels and opening of membrane potassium channels. This leads to hyperpolarization of the cell membrane potential and suppression of action potential transmission of ascending pain pathways.

Tramadol is an analgesic with mixed opioid and non-opioid activity. It inhibits reuptake of Nor epinephrine (NE) and Serotonin from the nerve endings and potentiate the effect of local anaesthetic when mixed together in peripheral regional nerve block. It has less respiratory depressant effect due to weak receptor affinity.

This present study was conducted to evaluate the effects of adding two opioids tramadol or butorphanol to local anaesthetic Bupivacaine and Lignoadrenaline in brachial plexus block through supraclavicular route in upper limb surgeries in terms of onset and duration of sensory and motor blockade and duration of analgesia.

Materials and Methods

After informed written valid consent, a study of 60 patients of either sex, ASA-I/II in the age group of 16–70 years, scheduled for various elective orthopaedic surgeries on upper limb under SCB. The study was done in a prospective, randomised double blinded comparative manner. Patients refusal, ASA grade III and IV, Any bleeding disorder or coagulopathy, Local infection at injection site, h/o allergy to local anaesthetic, Severe respiratory disease, Patients with h/o peptic ulcer disease, diabetes, hepatic or renal failure (contraindication to steroids), Pregnant women were excluded from the study.

For elimination of bias in the assigned study, randomization was done by computer generated random number table and care was taken that each patient should get equal chance. All patients were divided into two groups:

Group A (Tramadol group): SCB will be given with 1.5% Xylocaine-adrenaline (1:200000)(15ml) + 0.5% Bupivacaine (15ml) + Tramadol 100mg (2ml).

Group B (Butorphanol group): SCB will be given with 1.5% xylocaine-adrenaline (1:200000)(15ml)+ 0.5% Bupivacaine (15ml)+Butorphanol 1mg (1ml).

As Lignocaine with adrenaline is marketed in 2% concentration, so 15 ml of drug was diluted to 20 ml with normal saline to get 1.5% concentration of Lignocaine with adrenaline. Preoperative assessment was done on previous day, detailed clinical history was taken, General and Systemic examination was done and investigated. Routine Investigations like complete hemogram, chest x-ray, ECG, Renal function test, liver function test, Blood sugar, serum electrolytes were documented. Patient was kept NBM for 6 hours. On the day of surgery, Written informed valid consent was taken. In operation theatre, Routine and standard monitoring like ECG, pulse oxymetry, NIBP applied and baseline values noted. Intravenous access established using 18G or 20G cannula. After giving premedication (glycopyrrolate 0.004mg/kg i.v. and ondansetron 0.1mg/kg), after thorough explanation of the procedure and emphasising the need for patient co-operation, SCB was given by the classical technique.

Technique: For performing brachial plexus blockade through supraclavicular approach we used Classical technique (Kulenkampff's). After placing the patient in dorsal recumbent position with head turned away from site of injection

with strict aseptic precautions midclavicular point, external jugular vein and subclavian artery pulsation were identified. About 2 cm above the mid clavicular point just lateral to subclavian artery pulsation, a 22 gauge 1.5 inch hypodermic needle attached with 2 ml saline filled syringe was introduced and directed caudal and medially until paraesthesia or motor response was elicited or the first rib was encountered.

After brachial plexus was located the drug was injected and before every incremental dose negative aspiration for blood was performed to avoid any intravascular placement

According to the drug administered the patients were randomly allocated to 2 groups:

Group A: Inj. Tramadol (100mg)

Group B: Inj. Butorphanol (1mg)

Heart rate, blood pressure, oxygen saturation were recorded before the procedure and at 5, 10, 15, 30, 45, 60, 90, 120 min and then every two hourly postoperatively till the complete wearing off of effect.

Onset of Sensory block was assessed every 2 min by atraumatic pin prick test in the areas innervated by radial, ulnar, and median nerves and compared with the same stimulation on contralateral hand. Sensory blockade was graded as

Grade 0: Sharp pain felt

Grade 1: Dull sensation felt

Grade 2: No sensation felt

Onset time was defined as time from injection of drug to a dull sensation on any of the nerve distribution.

Sensory Peak effect time is defined as time from injection of drug to complete loss of sensation along all the nerve distribution.

Duration of sensory block was defined as time between the peak effect time and feeling of dull sensation in any of the nerve distribution.

Onset of wearing off of sensory block starts from feeling of dull sensation in any of the nerve distribution.

Complete wearing off of sensory block is defined as sharp pain felt in all the nerve distribution.

Similarly, onset of motor block was evaluated by asking the patient to move the forearm against resistance and to flex the forearm. Motor blockade was graded by four point scale

Grade 0: Complete movement of fingers and wrist.

Grade 1: Reduced movement of fingers and wrist

Grade 2: Only elbow movement

Grade 3: No movement.

Onset time was considered from injection of drug to patient felt heaviness on abduction of arm at shoulder.

Motor Peak effect time was from injection of drug to absence of any voluntary movement at the level of arm and forearm.

Duration of motor blockade was defined as between the onset of peak motor effect and the onset of weaning of motor effect in any of the nerve distribution.

Onset of wearing off of motor blockade is the time when reduced movement of fingers and wrist is present.

Complete wearing off of motor blockade is the time when complete movement of wrist and fingers return.

Patients were observed for any systemic side effects like bradycardia, hypotension etc. Intra operative data were recorded at every 15–30 minute interval. Tourniquet inflation and deflation time and duration of surgery were noted.

Intensity of post-operative pain was evaluated using VAS with grade 0 (no pain) to 10 (worst pain). Pain score were noted every 5 to 10 minutes initially then hourly till the patient regain VAS score of 4. Analgesia was considered satisfactory if the score was 3 or less. If score was more than 4, analgesia was judged unsatisfactory and rescue analgesia was administrated and time for need of first analgesia was noted. Evaluation was stopped when complete wearing off of effect occurred. Both groups were compared for duration of analgesia, duration of sensory block, duration of motor block. All the observations were recorded as mean and standard deviation. All the results were analysed statistically using the student's unpaired `t` test. p value <0.05 was considered as significant.

Results

All the patients were randomly and equally divided into two groups with 30 patients in each group (n= 30).

Group A: Inj. Bupivacaine 0.5% (15ml)+Inj Xyloadrenaline (15) ml +inj Tramadol(100mg) 2ml+Inj NS 3 ml.

Group B: Inj. Bupivacaine 0.5% (15ml)+Inj Xyloadrenaline (15)ml + inj Butorphanol (1mg)1ml + Inj NS 4ml.

Demographic data between two groups were comparable (Table 1).

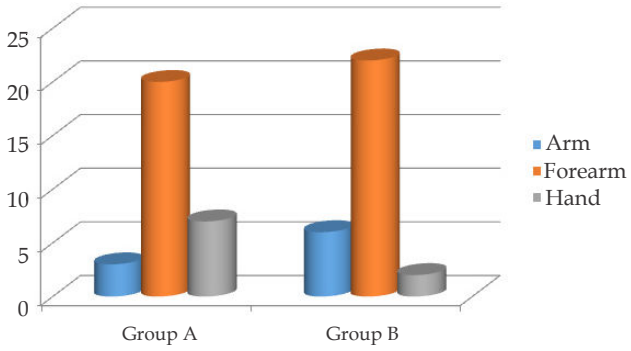
Distribution of different type of surgery is almost similar between both groups (Table 2, Graph 1).

Table 1: Demographic data.

Variables	Group A	Group B
1. Age in yrs		
Mean	35.6	36.06
Standard deviation	12.6	11.15
2. Wt. in kg		
Mean	65.94	65.22
Standard deviation	4.40	4.68
3. Sex ratio		
M:F	24:06	27:03

Table 2: Type of Surgery.

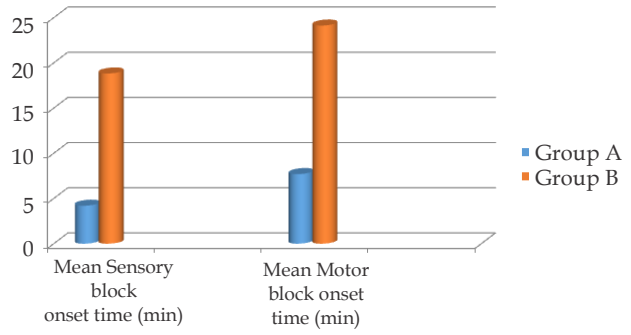
	Arm	Forearm	Hand
Group A	3	20	7
Group B	6	22	2



Graph 1: Type of Surgery.

Table 3: Time for Onset of Sensory and Motor Block.

	Sensory block onset time (min)		Motor block onset time (min)	
	Mean	Sd	Mean	Sd
Group A	4.20	1.34	7.70	1.50
Group B	18.83	1.29	24.13	2.14
p-value	<0.0001		<0.0001	



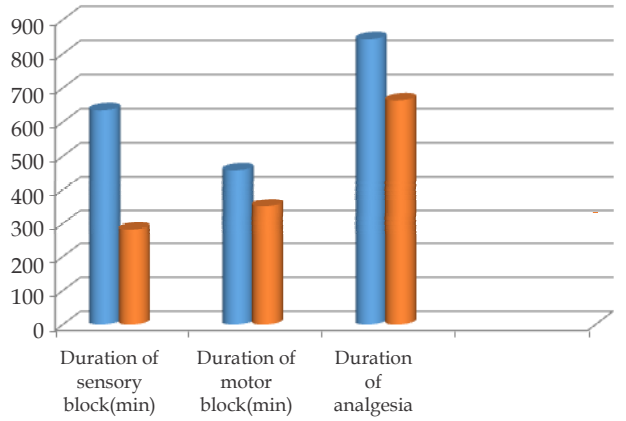
Graph 2: Time for Onset of Sensory and Motor Block.

The onset of sensory block was rapid with Tramadol (4.2 min) as compared to Butorphanol (18.83 min) and onset of motor blockade was also faster with Tramadol (7.7min) as compared to Butorphanol (24.13min) (Table 3, Graph 2).

Tramadol has longer duration of sensory (634.66 min with sd 25.78 min (10.14 to 11 hrs) and motor (458.33 min with sd of 35.22 (7.01 to 8.22 hr) blockade as compared with butorphanol group(282.03min with sd of 17.04 min (4.41 to 4.98 hr) and (350.16min with sd of 20.14min (5.50 to 6.17 hr) respectively. ($p<0.05$) (Table 4, Graph 3).

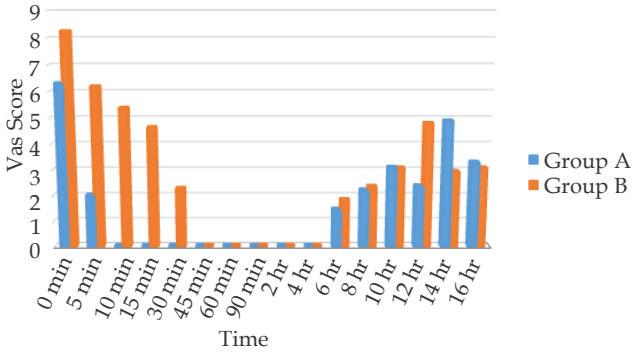
Table 4: Duration of Anaesthesia and Analgesia.

	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Duration of sensory block (min)	634.66	25.78	282.03	17.04	<0.0001 (S*)
Duration of motor block (min)	458.33	35.22	350.16	20.10	<0.0001 (S**)
Duration of analgesia (min)	842.66	82.88	663.3	20.54	<0.0001 (S*)



Graph 3: Duration of Anaesthesia and Analgesia.

Duration of surgery (Table 5) and VAS Score (Table 6, Graph 4) was also similar in both groups and statistically not significant.



Graph 4: Vas Score.

Table 5: Duration of Surgery (Min).

Duration of surgery	Group A	Group B
0-60	19	25
61-120	11	5
Minimum duration (min)	35	30
Maximum duration (min)	120	120
Mean + SD	61.3±17.46	56.5±19.7

Table 6: Vas Score.

Post–operative duration	Mean VAS Score	
	Group A	Group B
0 Min	6.3	8.24
5 Min	2	6.18
10 Min	0	5.36
15 Min	0	4.62
30 Min	0	2.260
45 min	0	0
60 min	0	0
90 min	0	0
2 hr	0	0
4 hr	0	0
6 hr	1.44	1.82
8 hr*	2.20	2.34
10 hr	3.08	3.06
12 hr	2.36	4.78
14 hr	4.88	2.92
16 hr	3.28	3.06

Complications: No significant intra-operative and post-operative complications like pneumothorax, intra-arterial or intravascular placement of drug, nausea, vomiting, neurotoxicity or cardiotoxicity were found in either group.

Discussion

Regional anaesthesia provides improved satisfaction and cause less cognitive impairment and immuno suppression compared to general anesthesia (particularly in elderly patients).[4] Peripheral nerve blocks offer an excellent alternative for patients in whom postoperative nausea and vomiting are a problem, who are at risk for development of malignant hyperthermia, or who are hemodynamically compromised or too ill to tolerate general anesthesia. SCB provides the most complete and reliable anaesthesia as it provides anaesthesia of the entire upper extremity in the most consistent, time efficient manner of many brachial plexus technique. It is performed at the trunk level where plexus is presented most compactly. This anatomic compactness is responsible for rapid onset, complete and reliable anaesthesia. Another advantage is that it can be performed with the patient's arm in any position to provide excellent anaesthesia for elbow, forearm and hand surgery.

Present randomized control study was done to evaluate the effect of adding tramadol and butorphanol to most commonly used local anaesthetic bupivacaine and xyloadrenaline in brachial plexus block through supraclavicular route posted for upper limb surgeries. The effects were evaluated in terms onset of sensory and motor block, duration of sensory and motor block and duration of analgesia in 60 patients of ASA physical status I/II.

Tramadol is a single entity centrally acting analgesic, used successfully for pain relief . Raffa Br et al and Reimann W[5] et al in their study described antinociceptive property of tramadol by opioid and non opioid mechanism . Reiman et al concluded from their study that tramadol inhibits noradrenaline uptake in the spinal cord contributing to its analgesic effect.

Demographic Data

All patients in our study were demographically similar in both groups. There were no statistically significant intergroup variations regarding age, body weight, and gender distribution.

Surgical Procedure and Duration of Surgery

Majority of patients had surgical procedures like K-wire, platting, nailing implant removal, external fixator, tendon or artery repair in upper limb and comparable in between the groups. Duration of surgery was also similar in both groups and statistically not significant.

Onset of Sensory and Motor Block

In present study, onset of sensory block was rapid with Tramadol as compared to Butorphanol. The mean onset time was 4.2 min in group A while it was 18.83 min with group B and the difference was statistically significant ($p<0.05$).

The onset of motor blockade was significantly faster with Tramadol as compared to Butorphanol ($p<0.05$). The mean duration of onset of motor block was 7.7min in group A and 24.13min in group B.

In one study in which tramadol was added to 20 ml of 7.5mg/ml ropivacaine, by Antonicci, it was demonstrated that tramadol significantly reduced the onset time of brachial plexus block and prolonged the duration of anaesthesia and postoperative analgesia .

Chatopadhyay et al[6] evaluated the use of tramadol 100mg as am adjuvant to bupivacaine 0.25%, total volume being 40 ml in supraclavicular brachial plexus block given for various upper limb surgeries and concluded that tramadol is useful adjuvant and reduces the onset time of motor and sensory block and enhances the duration of sensory block , motor block and postoperative analgesia

Duration of Sensory and Motor Block

In present study, Tramadol has longer duration of sensory and motor blockade as compared with But orphanol group. The mean duration of sensory block was 634.66 min with SD 25.78 min (10.14 to 11 hrs) with group A and it was 282.03min with SD of 17.04 min (4.41 to 4.98 hr) with group B and the difference was statistically significant ($p<0.01$).

The duration of motor block was significantly prolonged with tramadol as compared to butorphanol ($p<0.05$). The mean duration of motor block was 458.33 min with SD of 35.22 (7.01 to 8.22 hr) with group A and it was 350.16min with SD of 20.14min (5.50 to 6.17 hr) with group B.

In one study done by Ahmet Can Senel[7] addition of 50 mg of tramadol to 0.375% of ropivacaine significantly prolonged the duration of sensory and motor blockade and post operative analgesia.

In a study done by Ranjit Acharya[8] addition of 2 mg of butorphanol to 0.5% bupivacaine for supraclavicular brachial plexus block results in significant increase in duration of motor blockade without affecting the time of onset of block . The duration of motor block in butorphanol group was 302+0.52min similar to our results.

Duration of Analgesia

Peripheral nerve block given with local anaesthetic drugs produce analgesia but to prolong the duration of post operative analgesia , many agents including variety of opioids have been used by various investigators. These include Morphine, Pethidine, Tramadol, Butorphanol and Buprenorphine . Primary afferent tissues have been found to contain opioid receptors.

There is a lot of evidence for presence of peripheral opioid receptors and their role in alleviation of pain.

Wajima Z et al[9] have studied inj. Butorphanol in local anaesthetic via continuous brachial plexus block and have demonstrated that Butorphanol produces pain relief in postoperative period. Veil and colleaugues have shown that inj of Biprenorphine 3 Microgram /kg in supraclavicular brachial plexus block produces significantly longer pain relief than morpine after upper limb surgery. In our study tramadol and Butorphanol have similar duration of post operative analgesia.

Robaux et al[10] conducted a randomised double blinded clinical trial to assess the effect of Tramadol added to brachial plexus anaesthesia in which 100 patients planned for carpal tunnel release surgery under brachial plexus anaesthesia were randomised into different groups (tramadol 40 mg, 100mg, 200mg). The number of patients requesting analgesia in post operative period was significantly less in tramadol 200mg . This study demonstrate that tramadol added to mepivacaine for brachial plexus block extends the duration and improve the quality of postoperative analgesia in a dose dependent fashion.

VAS (Visual Analogue Scale) SCORE

Rescue analgesic was given when patient develop VAS score ≥ 4. In majority of patients, it was achieved at around 12 to 14 hrs in both the groups. Results were clinically comparable and difference between two group statistically significant ($p<0.05$).

Both the groups have similar trends of VAS score.

Complications

No significant intra-operative and post-operative complications like pneumothorax, intra-arterial or intravascular placement of drug, nausea, vomiting, neurotoxicity or cardiotoxicity were found in either group.

Conclusion

The supraclavicular approach provides the most complete and reliable anaesthesia of the entire upper extremity in the most consistent, time efficient manner of many brachial plexus technique. To conclude the study, we observed that

opioids when added to local anaesthetic agent in supraclavicular brachial plexus block prolong the analgesia . Tramadol greatly reduce the onset time for sensory and motor block as well prolong the sensory and motor block , while Butorphanol has minimal effect on onset and duration of block but it provide post op analgesia .

Abbreviations

SCB: Supraclavicular brachial plexus block

VAS: Visual Analogue Score

PR: Pulse Rate

ECG: electrocardiogram

BP: Blood Pressure

References

1. Moore D C, Bridenbaugh L D, Eather K F: Block of upper extremity supraclavicular approach versus axillary approach . Arch.Surg.1965; 90: 68–72.
2. Young W S, Wamsley K, Zarbin M A, Kuhar M A: Opioid Receptors undergo axonal flow. Science 1980; 210:76.
3. Fields HL, Emson PC, Leigh BK, et al. Multiple opioid receptor sites on primary afferent fibres. Nature 1980; 284: 351–353.
4. Mahajan B K.: Methods in biostatistics; sixth edition,1997.
5. Raffa BR, Friderichs, Reimann W, Shank R F, Codd EE: Opioids and nonopioid components independently contribute to the mechanism of action of tramadol , an " Atypical" opioid analgesic. The Journal of Pharmacology and experimental therapeutics. 1991; 260 [1] 275–285.
6. Chattopadhyay S, Mitra LG, Biswas BN, Majumder P. Tramadol as an adjuvant for Brachial Plexus Block. J Anaesth Clin Pharmacol 2007; 23(2) : 187–9.
7. Ahmet Can Senel, Ozlem Ukinc and Alper Timur Kayank et al: Does the addition of Tramadol and ketamine to ropivacaine prolong the axilary brachial plexus block. Bio med research International Volume 2014 (2014), Article ID 686287, 5 pages.
8. Ranjita Acharya, Monalisa Jena, Swati Mishra, Shovan Kumar Rathi et al: Effect of Butorphanol versus Placebo as adjuvant to Butorphanol for Supraclavicular Brachial Plexus blockade . International journal of applied Pharmaceutics ISSN– 0975–7058. Vol 6 , Issue 1, 2014.
9. Wajima Z, Nakajima Y, Kim C, Kobayashi N, Kadotani H, Adachi H et al. IV Compared with brachial plexus infusion of butorphanol for post operative analgesia. Br J Anaesth 1995;74:392–395.
10. Robaux S, Blunt C, Viel E et al: tramadol added to 1.5 % Mepivacaine for axillary brachial plexus block improves postoperative analgesia. Anaesth Analg 2004 april ;98(4):1172–7.