Original article :

A comparative study between buprenorphine and tramadol with bupivacaine (0.25%) in supraclavicular block for upper limb surgeries

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Abstract

Abstract: A comparative study between buprenorphine and tramadol with bupivacaine (0.25%) in supraclavicular block for upper limb surgeries.

Background and Aims: Brachial plexus block is a reliable, regional anaesthetic technique for upper limb surgeries. Various opioid additives have been tried to prolong brachial plexus blockade. The search for better compound led to the discovery of opioids like tramadol, butarphanol and buprenorphine.

Methods: Sixty patients of American society of anaesthesiologist's physical status I and II of both genders were posted for routine or emergency forearm and hand surgeries. These patients were allocated randomly in two groups with thirty patients each to receive either 40ml of 0.25% bupivacaine with 2mcg/kg buprenorphine (Group 1) or 40ml of 0.25% bupivacaine with 2mg/kg tramadol (Group 2) in supraclavicular brachial plexus block. The patients were observed for the onset and duration of sensory and motor blockade along with hemodynamics and side effects if any.

Results: The study demonstrates that the mixture of buprenorphine and bupivacaine injected perineurally can provide early onset of sensory and motor blockade. Buprenorphine also enhances the duration of postoperative analgesia.

Conclusion: In conclusion, the perineural injection of buprenorphine in the dose of 2mcg/kg with bupivacaine provides early and profound sensory and motor blockade as well as good postoperative analgesia without any side effects when compared with tramadol 2mg/kg with bupivacaine.

Keywords: Supraclavicular block, opoids, bupivacaine, buprenorphine.

Introduction:

Pain is a personal and subjective experience that inviolves sensory, emotional and behavioral factors associated with actual or potential tissue injury as defined by th International Association for the study of Pain[1]. It has also defined pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described inn terms of such damage[2]. Pain frequently hampers the implementation of ambulatory surgery in spite of so many analgesic drugs

and regimens[3].The consquence of severe postoperative pain such as prolonged hospital stay, increased hospital readmission and increase opoid use with a subsequent increase in postoperative nausea and vomiting which results in overall low patient satisfaction and potentially greater cost[4].

Upper limb surgeries are mostly performed under peripheral blocks such as the brachial plexus block. Peripheral nerve blocks provide intraoperative anesthesia as well as it extends analgesia in the postoperative period without major systemic side effects by minimizing stress response and using minimal analgesic drugs[5]. The supraclavicular brachial plexus block has many advantage over other approaches to brachial plexus block. It provides complete and reliable anaesthesia for upper limb surgury. It is performed at the level of trunk where the plexus is presented most commonly[6].

Bupivacaine relieved pain by blocking the transmission of pain signals to the dorsal horn but it has definte risk of systemic toxicity, especially with brachial plexus block.various adjuvants are used to augment the analgesic efficacy while reducing the dose and incidence of adverse reactions related to local anaesthetics[7]. So many adjuvants added to local anaesthetics to prolong the block, increase the duration and reduce the toxicity like opioid[8], dexamethasone[9], and clonidine[10].

Buprenorphine is a partial agonist of opiate receptor. The analgesic effect of buprenorphine is 25 times more than that of morphine[11]. It has been tried through various route viz IV, IM, epidural, spinal, peripheral blocks. Buprenorphine injection into the brachial plexus sheath is an efficient way to assure control of postoperative pain relief after upper limb surgery[12].

Tramadol is a centrally acting analgesic having central opiate receptor agonist activity. It is a recemic mixture of two enantiomers with mixed agonist properties.it exhibits serotonergic activity and inhibits nor epinephrine reuptake. The action of these enantiomers is both complementary and synergistic[13]. It has found to have a unique mechanism of action that suggests its efficacy as an adjunct to local anaesthetics in brchial plexus block.

The present study was designed to compare the efficacy of buprenorphine and tramadol when added as an adjuvant to bupivacaine in supraclavicula brachial plexus block interms of onset of sensory and motor blockade, duration of postoperative pain relief and side effects if any.

Methods:

After obtaining institutional ethical committee approval and written informed consent, 60 patients of either sex between 18 to 50 years of age having american society of anaesthesiologist grade I or II physical status were posted for forearm and hand surgeries. Patients having american society of anaesthesiologist grade III onwards, CNS or psychiatric dysfunction, bleeding disorders, hyperthyroidism and congenital and ischaemic heart diseases were excluded.

The patients under the study went throught pre-operative assesment including detailed case history, physical examination and all necessary investigations. All patients were tested for kept nil orally for at least 6 hrs before the procedure. On arrival to the operation theater, standard monitoring was established. They were premedicated with Inj Ranitidine 2mg/kg and Inj ondansetron 0.1mg/kg IV. After proper positioning of the patient and under all aseptic precautions supraclavicular brachial plexus block was performed by using nerve stimulator. Indication of

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correcr placement of needle is either by fascial click, paraesthesia of forearm and hand or visible contraction of the muscles of the upper extrimity. The drug was then injected slowly after repeated aspirations.

These patients were randomly assigned in 2 different groups. Out of which group 1 recieved 40ml of 0.25% bupivacaine with 2mcg/kg buprenorphine and group 2 recieved 40ml of 0.25% bupivacaine with 2mg/kg tramadol. All local anaesthetic solutions and adjuvant drugs were prepared by an anaesthesiologist not involved in the performance of brachial plexus block, patient care and data collection.

Sensory blockade was assessed by pinprick and compared on the contralateral arm. Sensory blockade was rated on a scale from 100%(normal sensation) to 0%(no sensation).

Motor blockade was evaluated by modified Bromage scale[14] for upper extrimities using 3 point scale. 0-total movement of fingers and wrist, 1- decreased motor strength with ability to move fingers only, 2- inability to move fingers.

Block was evaluated at specific time interval till motor and sensory block after the injection of local anaesthetic. Block assesment was done till 12 hours.

Onset of sensory blockade was defined as the interval between the end of injection and sensory blockade was demonstrated as loss of sensation to pinprick. Onset of motor blockade was the interval between the end of injection and paresis in all the nerve distribution. The duration of sensory blockade being the time interval between sensory blockade and the first postoperative pain. The duration of motor blockade was defined as the time interval between maximum motor blockade and complete movement wrist and fingers. Duration of analgesia was taken as the time interval between onset of sensory blockade and the first dose of rescue analgesic given to the patient.

Postoperative pain was done using 10 point verbal respose score, 0- no pain to 10- worst pain at specific time interval till demand of rescue analgesia which is given in the form of Injection diclofenac 75mg intramuscularly.

Intraoperatively baseline pulse rate, blood pressure, respiratory rate and SPO_2 were monitored. For continuous neurological evaluation, no sedative drugs were administered intraoperatively. Additonally nausea, vomititng, itching, urinary retention and respiratory depression were recorded.

The demographic parameters such as age and weight were expressed with standard deviation. The demographic and haemodynamic data were analyzed by Student`s t-test. For statastical analysis of onset and duration of sensory as well motor blockade and duration of analgesia, unpaired t-test was applied.$P<0.05$ was considered as statastically significant. For intra-group analysis, a repeated measure ANOVA was performed.

Results:

The age and weight were comparable in two groups. Comparing pulse rate and blood pressure changes (table I & II) among these two groups, there was drop in pulse rate and blood pressure after 5 min in group1(Buprenorphine) which was statistically significant($p=0.03$). The comparison

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of respiratory rate (table III) in two groups showed decreased rate significant (p=0.001) earlier in group1 (Buprenorphine), while the two groups were having comparable SPO_2

On assessing sensory blockade in two groups (table IV), it was observed that Buprenorphine group was having early onset and longer duration than Tramadol group, which was highly significant (p=0.001). On comparison of motor blockade among two groups (table V), it was found that the onset of motor blockade was earlier with Buprenorphine as compared with Tramadol, which was highly significant (p=0.001).

Discussion:

Surgical stress and pain elicit a consistent and well defined metabolic response, involving release of neuroendocrine hormones and cytokines, that lead to myriad of detrimental effects. General anaesthesia either with intravenous or inhalational agents not effectively attenuate the neuroendocrine stress response. One exception is administration of high dose of opioid anaesthesia but lower doses of opioid usually are unable to hinder the stress response.

Regional anaesthesia and analgesia is ideally suited to produce mitigation of nociception because it diminishes the intensity of afferent impulses reaching the spinal cord. Regional techniques reduce the catecholamine and other stress hormone responses during the perioperative period. Besides reducing the neuroendocrine stress response, regional anaesthesia also reduces myocardial work and oxygen consumption by reducing heart rate, arterial pressure and left ventricular contractility. To improve the outcome of surgery, it is necessary to extend into the postoperative period all the advantage of the regional anaesthesia.

A Supraclavicular approach to the brachial plexus is anaesthetically efficient, a small volume of solution can provide excellent anaesthesia for upper limb surgeries. It is observed that the onset, quality and duration of sensory and motor blockade are faster in supraclavicular block[15]. Also due to its superficial location the approach is technically easy with rare complications.

Therefore in our study, we prefered perineural route (supraclavicular appraoch) for comparison between buprenorphine and tramadol. Here, we compared buprenorphine and tramadol for onset of sensory and motor blockade as well duration of analgesia. Also changes in vital parameters were noted in both the groups throughout the study. The age and weight distribution of the patients in these groups were comparable.

Comparing pulse rate and blood pressure change (Table 1&2) among these two groups, we found significant change in pusle rate and blood pressure with in 2 min in group I. It may be due to elimination of anxiety and pain but there was no evidence of bradycardia or hypotension. Grills et all[16] reported no significant change in blood pressure and heart rate, eventually no signoficant alteration in hemodynamic status.

Narcotics are known respiratory depressants. The clinical pecularity of narcotics induced respiratory depression is decrease in respiratory rate more than decrease in tidal volume. Hence we monitored the respiratory rate in our patients to detect respiratory depression. After comparing(Table 3&4), we found there was significant decrease in respiratory rate in group I but

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no evidence of respiratory depression. There was no alteration in the SpO_2 of the observed patients in either of the groups.

Assesment of pain is difficult beacuse it is a subjective sensation. Pain being a subjective penomenon, its measurement is difficult and can be measured relying only on the quality and magnitude told by the subject. In our study sensory bolckade was rated on a scale from 100%(normal sensation) to 0%(no sensation). After comparing (Table 5), the sensory blockade in group I was 26.33±19.38 while in group II was 95.33±8.19 minutes. This showed that the onset of sensory blockade was early in group I as compared to group II and which is statistically significant. Also the comparison could be conducted up to 8 hours only as most of the patients in the tramadol group rescue analgesics. The mean duration of analgesia in group I was 14±2 hours while in group II was 6±2 hours. This showed that the postoperative analgesia was prolonged in group I as compared to group II and was statically significant. As per the study of Bazin JE et al[17], the duration of analgesia produced buprenorphine is approximately 20 hours.

On comparing the motor blockade in two groups (Table 6), the onset of motor blockade in group I was 3.63±0.85 minutes, which lasted for duration of 564±37.29 minutes whereas the onset of motor blockade in group II was 5.36±1.22 which lasted for only 320±65.13 minutes. The difference is statistically and clinically highly significant.

Conclusion:

The present study demonstrates that the perineural injection of buprenorphine with bupivacaine can provide early onset of sensory and motor blockade as well enhances the duration of postoperative analgesia without any side effects. This comparative study also showed that the perineural injection of buprenorphine in the dose of 2mcg/kg with bupivacaine provides early and profound sensory and motor blockade as well as good postoperative analgesia without any side effects when compared with tramadol 2mg/kg with bupivacaine.

Table 1: Comparison of pulse rate between Buprenorphine and Tramadol groups

Time points	Pulse mean ± SD		Significance
	Buprenorphine	Tramadol	
Baseline	80.87±6.66	80±6.1	0.60
1 min	78.80±6.03	80±6.1	0.45
2 min	75.27±5.64	79.8±5.97	0.001
5 min	73.73±5.96	79.47±5.92	0.001
15 min	73.20±6.07	78.93±5.79	0.001
60 min	73.07±5.67	78.13±5.46	0.001
240 min	73.13±5.4	78.33±5.54	0.001
480 min	73.4±5.15	79.47±5.35	0.001

P value is significant if $p<0.05$ and highly significant if $p<0.01$

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Table 2: Comparison of blood pressure between Buprenorphine and Tramadol groups

Time points	Blood pressure ± SD		Significance
	Buprenorphine	Tramadol	
Baseline	118.67±11.3	117±10.06	0.55
1 min	116±9.41	117±10.06	0.69
2 min	112.73±8.86	116.93±9.98	0.09
5 min	111.27±7.92	116.47±9.68	0.03
15 min	110.8±7.66	115.93±9.61	0.03
60 min	110.8±7.64	115.53±9.49	0.04
240 min	107.77±19.4	115.53±9.49	0.05
480 min	111.13±7.31	117±9.78	0.01

P value is significant if p<0.05 and highly significant if p<0.01

Table 3: Comparison of respiratory rate between Buprenorphine and Tramadol groups

Time points	Respiratory rate ± SD		Significance
	Buprenorphine	Tramadol	
Baseline	19±2.67	21.13±2.66	0.001
1 min	17.4±1.83	21.13±2.66	0.001
2 min	16.33±1.06	20.93±2.77	0.001
5 min	15.87±0.73	20±2.57	0.001
15 min	15.93±0.36	18.47±2.21	0.001
60 min	15.93±0.36	17.13±1.94	0.001
240 min	15.93±0.36	16.73±1.7	0.001
480 min	16.13±0.5	17.4±2.04	0.001

P value is significant if p<0.05 and highly significant if p<0.01

Table 4: Comparison of SpO_2 between Buprenorphine and Tramadol groups

Time points	SpO_2 mean ± SD		Significance
	Buprenorphine	Tramadol	
Baseline	99±0	99±0	_
1 min	99±0	99±0	_
2 min	99±0	99±0	_
5 min	99±0	99±0	_
15 min	99±0	99±0	_
60 min	99±0	99±0	_
240 min	99±0	99±0	_
480 min	98.7±1.64	99±0	0.32

P value is significant if $p<0.05$ and highly significant if $p<0.01$

Table 5: Comparison of Sensory blockade between Buprenorphine and Tramadol groups

Time points	Sensory blockade mean ± SD		Significance
	Buprenorphine	Tramadol	
Baseline	100±0	100±0	_
1 min	66.67±12.13	100±0	0.001
2 min	99±0	95.33±8.19	0.001
5 min	99±0	73±13.9	0.001
15 min	0	37.33±19.9	0.001
60 min	0	4.67±11.37	0.03
240 min	0	22.67±13.3	0.001
480 min	3.33±8.44	77±16.2	0.001

P value is significant if $p<0.5$ and highly significant if $p<0.01$

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Table 6: Comparison of Motor blockade between Buprenorphine and Tramadol groups

Motor blockade	Buprenorphine	Tramadol	Significance
Onset(mins)	3.63±0.85	5.36±1.22	0.001
Peak(mins)	6.53±1.43	14.26±3.7	0.001
Duration (mins)	564±37.29	320±65.13	0.001

P value is significant if $p<0.5$ and highly significant if $p<0.01$

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