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Original research article: Comparative study between tramadol and dexamethasone with bupivacaine in supraclavicular brachial plexus block

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Abstract
Background: Peripheral nerve block causes sympathetic block with resultant improvement in blood flow hence lessen postoperative vasospasm, tissue anoxia, pain edema which is more favourable in acute hand and reconstructive surgery. Peripheral nerve block remains a well accepted component of comprehensive anesthetic care since Hall first reported the use of cocaine to block upper extremity nerve in 1884.
Objectives: To compare the postoperative analgesia following supraclavicular brachial plexus block with Tramadol or Dexamethasone as an adjuvant to bupivacaine in elective upper extremity surgery.
Methodology: Total 60 patients of ASA I and II undergoing upper extremity surgery under brachial plexus block with Bupivacaine were randomly divided in to two groups; group A received Tramadol (2mg/kg) and group B received Dexamethasone (0.15mg/kg) as an adjuvant to Bupivacaine. The duration of postoperative analgesia was recorded in both groups using pain VAS score which was determined by maximum VAS score of 8-10 and when patient demands for additional analgesics.
Results: The mean duration of postoperative analgesia in the Dexamethasone group was 1023.87 ± 161.01 minutes while in the tramadol group it was 454.47 ± 44.29 minutes.
Conclusion: Dexamethasone with local anaesthetic prolongs postoperative analgesia significantly than Tramadol ($P<0.05$) when used as admixture to local anaesthetic in brachial plexus block in upper extremity surgery.

Keywords: dexamethasone, tramadol, bupivacaine

Introduction

Peripheral nerve blocks are being used as a sole anaesthetic technique to facilitate painless surgery supplemented with monitored anaesthesia care. They offer better and longer pain relief and are becoming popular for ambulatory anaesthesia. Ambulatory surgery is becoming increasingly desirable because it offers massive economic advantage, much comfortable and convenient for the patient. It plays a major role in day care surgeries where top priority of success are: alertness, ambulation, and analgesia [1].

Brachial plexus blockade is one of the approaches to sensorimotor regional neural blockade by which surgical anaesthesia of the upper limb may be achieved. Any surgical procedure on upper limb, for example, reduction of fractures or dislocations, debridement, tendon repair can be performed with brachial plexus block avoiding the major physiological trespass associated with induction of general anaesthesia [2].

These peripheral nerve blocks provide an excellent alternative for patients who are at a high risk for general anaesthesia. It is safer in high risk patients with cardiopulmonary diseases, diabetes or other chronic illness as it minimally disturbs coronary hemodynamics and also blunts the stress response to surgery. Grave complications of general anaesthesia like vomiting and aspiration, where patients are considered to be full stomach, are avoided [3, 4].

The supraclavicular perivascular method produce the most complete blocks whereas the axillary technique does not block the shoulder. Interscalene often misses the ulnar aspect of hand and forearm [5].

The approach being used in this study is the classical supraclavicular block. This block provides anaesthesia for the entire upper extremity in most consistent and efficient manner and can be performed with arm in virtually any position.

A number of studies have been done on use of steroids in nerve blocks due to their effect on analgesia.

Present study was done to determine the effect of tramadol 2 mg / kg and dexemethasone 0.15mg/kg added to bupivacaine 0.5% on onset and duration of analgesia and motor block and also to evaluate the side effects: hypotension, bradycardia, sedation in supraclavicular brachial plexus block.

Material and Methods

The study was conducted in the Department of Anaesthesia, S.M.S Medical College, Jaipur. This double-blinded controlled study included 60 patients (age 20-50years) undergoing elective surgery in upper limb.

Group A: (n=30) received 0.5% bupivacaine 2mg/kg and inj. Tramadol 2mg/kg.

Group B: (n=30) received 0.5% bupivacaine 2mg/kg and inj. Dexamethasone one 0.15 mg/kg.

All the solutions were diluted with normal saline to make a total volume of 30 ml.

Inclusion criteria

Patients of either sex. Age group between 20 and 50 years. Patients belonging to ASA class-I and II. Patients undergoing elective surgical procedure on upper limb.

Exclusion criteria

Patients not willing to participate in the study. Uncooperative patients. Local pathology at the site of injection or disability limiting the performance of block. History of convulsion, allergy to the drug used, bleeding disorder, severe neurological deficit, Patient with history of respiratory, cardiac, hepatic or renal failure Pre anaesthetic check up was done a day before the surgery.

Patients were randomly allocated by chit and box method to one of the two groups of 30 patients each. Group A received 0.5% Bupivacaine 2 mg/kg with Tramadol 2 mg/kg and group B received 0.5% Bupivacaine 2 mg/kg with Dexamethasone 0.15mg/kg. Normal saline added to make total volume 30 ml.

Fasting status, consent, PAC checked, and intravenous access secured. Patients did not receive any premedication. The patient was placed in the supine position, with the head turned away and the ipsilateral arm adducted. The interscalene groove and mid-point of the clavicle and subclavian artery were identified. After aseptic preparation of the area, at a point 1.5 to 2.0 cm posterior to midpoint of the clavicle a skin wheal was raised with a local anaesthetic (lignocaine2% plain). Next, a 22G, 50 mm "short beveled" needle was passed through the same point in a caudal, slightly medial and posterior direction, until either a paresthesia is elicited or the first rib is encountered. If the first rib was encountered, the needle was moved over the first rib until a paresthesia was elicited either in the hand or arm. After eliciting paresthesia and negative aspiration of blood, the study medication was injected.

After performance of nerve block patients were evaluated for onset of sensory block every 1 minute. The sensory block was assessed by pin prick with 25 gauge needle.

Heart rate, non-invasive blood pressure, SPO2 & sedation score were measured every 5 minutes during first 30 minutes and thereafter half hourly till the end of procedure. Postoperatively heart rate, noninvasive blood pressure, pain and sedation scores were recorded at 0, 30 min,1 hrs, 3 hrs, 6 hrs, 12 hrs, 18 hrs. Sensory and motor block were assessed as follows:

Sensory block

0. Sharp pain,
1. Touch sensation only.
2. Not even touch sensation.

Motor block (modified bromage scale)

0. No block – total arm and forearm flexion
1. Partial block – total forearm and partial arm flexion
2. Almost complete block - inability to flex the arm and decreased ability to flex the forearm.
3. Total block - inability to flex both the arm and forearm

Sedation was assessed using a four point scale

1. Awake and alert.
2. Drowsy but responsive to command.
3. Very drowsy but responsive to pain.
4. Unresponsive

The surgery was allowed to proceed when complete anesthesia was achieved. The duration of surgery in each case was noted.

Postoperative follow up was carried out in the recovery and postoperative ward. The duration of analgesia was noted according to the 0-10 visual analogue scale (VAS) for pain at 0, 30 min.,1 hour, 3 hour, 6 hour, 9 hour, 12 hour, 18 hours.

VAS score 0 and 8-10 were taken as no pain and worst pain perceived, respectively. The duration of analgesia was determined till the existence of good analgesia.

When the patients began to experience the worst pain (VAS= 8-10), it was considered that the analgesic action of the drugs was terminated. Patients were then rescued with additional analgesics on demand.

The duration of motor block postoperatively by asking patient to move their fingers and to see whether they are able to raise the hand or not. This time was recorded and taken as cessation of motor block effect.

None of the patients were routinely sedated or given extra analgesics; until they started complain of pain.

If any side effects related to the technique or drug such as nausea, vomiting, respiratory depression, pneumothorax occurred they were recorded and treated accordingly. The patient characteristics (age, sex, weight), duration of onset of sensory/motor block, duration of analgesia were recorded.

The comparison between the two groups with respect to demographic variables was done by unpaired t-test. Intraoperative HR, BP, RR, SPO2 was analysed by using unpaired t-test. The onset and duration of sensory and motor blocks were compared between two groups using unpaired t-test. P value<0.05 was considered significant.

Results

The mean age in years and mean body weight in kgs. along with standard deviation is depicted in Table 1.

Table 1: Mean age and body weight of each group

	Group A (mean±SD)	**Group B (mean±SD)**	**P value**	
Age(yrs)	33.53 ± 7.49	34.36 ± 7.79	0.6745	NS
Body wt (kgs)	59.83 ± 4.77	59.96 ± 5.30	0.9189	NS

It was observed that mean age and body weight was similar in both the groups and no statistically significant difference was present.

Table 2: Mean duration of surgery of each group

	Group A (mean ± SD)	**Group B** (mean ± SD)	**P value**	**Significance**
Duration of surgery (Min)	53.5 ± 10.18	53.00 ±11.64	0.8601	NS

It was observed that mean duration of surgery was similar in both the groups and no statistically significant difference was present. (Table 2).

Table 3: Type and distribution of various surgeries in the groups

Surgery / procedure	Group A	Group B
# Both bones forearm – ORIF	4	6
Monteggia # - ORIF	3	3
# Radius – radial head removal/ ORIF	5	4
# Olecranon – ORIF	4	2
# Ulna / non union ulna – ulna plating	5	3
Galezzi # ORIF	3	0
Crush injury- debridement & repair	2	2
# humerus / non union humerus – ORIF	2	4
Carpel tunnel syndrome – release	1	2
PB Contracture hand – release	1	4
Total	30	30

Table 3 shows the distribution of various surgeries among the two groups.

Table 4: Onset of sensory analgesia and motor block

	Group A (mean ± SD)	Group B (mean ± SD)	P value	Significance
Onset of sensory block in min	18.20 ± 1.47	14.83 ± 2.61	0.000	HS
Onset of motor block in(min)	13.07± 1.36	12.93± 2.15	0.7751	NS

The mean onset of sensory block and motor block along with standard deviation is depicted in Table 4.

Table 5: Grade of sensory block(no. of patients)

Group	Grade 0	Grade 1	Grade 2	Total
A	0	8(26.67%)	22 (73.33%)	30
B	0	5(16.67%)	25(83.33%)	30

Table 5 shows that 22 out of 30 patients in group A and 25 out of 30 patients in group B had sensory block grade 2 means no response even to touch sensation. 8 patients in group A and 5 patients in group B had touch sensation only and no response to any pain stimuli.

Table 6: Grade of motor block (no.of patients)

	Grade 0	Grade1	Grade2	Grade3	Total
Group A	0	0	8	22	30
Group B	0	0	4	26	30

Table 6 shows that 22 patients in group A and 26 patients in group B showed complete motor block with inability to flex the arm and forearm while 8 in group A and 4 in group B were able to flex the forearm but unable to flex the arm.

Table 7: Duration of analgesia and motor block

	Group A (mean ±SD)	Group B (mean ±SD)	P value	Significance
Duration of analgesia (min)	454.4± 44.29	1023.87 ±161.01	0.000	HS
Duration of motor block (min)	356.10±54.81	513.17 ± 75.09	0.000	HS

Table 7 shows the mean duration of analgesia and motor block in both the groups.

Table 8: Degree of sedation

S. No.	Degree of Sedation	Group A	Group B
1	Awake and alert	27	30
2	Drowsy but responsive to command	3	0
3	Very drowsy but responsive to pain	0	0
4	Unresponsive	0	0

Table 8 shows the degree of sedation in both the groups. In group B all patients were awake and alert. In group A three out of thirty showed mild sedation.

Table 9: Pain score

	Group A	Group B	P value	Significance
Severity of pain at first analgesic requirement	6.63 ± 1.00	4.77 ± 0.82	0.0000	HS

Table 9 shows the mean severity of pain at first analgesic requirement between the two groups. Group A showed more severity of pain than group B and it was found to be statistically significant.

Table 10: Baseline clinical variables(Mean ± SD)

	Group A	Group B	P value	Significance
Baseline HR	83.03 ± 5.01	83.13 ±5.08	0.9391	NS
Baseline SBP	123.00 ± 6.03	123.33 ±6.09	0.8320	NS
Baseline DBP	77.07 ± 5.48	77.73 ± 6.05	0.6563	NS
Baseline RR	14.73 ± 0.78	14.80 ±0.71	0.7321	NS
Baseline SPO2	99.80 ± 0.41	99.87 ± 0.35	0.4968	NS

Table 11: Effect on heart rate (Mean ± SD)

Group	Pre operative	Mean Intraoperative	P value	Significance
A	83.03 ± 5.01	82.59 ± 4.62	0.18	NS
B	83.13 ± 5.08	82.88 ± 4.27	0.82	NS

Table 11a: Effect on heart rate (Mean ± SD)

Group	Pre operative	Mean post operative (at 0, 30, 60, 180 min)	P value	Significance
A	83.03 ± 5.01	82.35 ± 5.08	0.60	NS
B	83.13 ± 5.08	82.73 ± 4.84	0.40	NS

The mean change in heart rate in intra operative period and post operative period from pre operative period is not significant. (P > 0.05).

Table 12: Effect on systolic BP (Mean ± SD)

Group	Pre operative	Mean Intraoperative	P value	Significance
A	123.00 ± 6.03	123.08 ± 6.15	0.94	NS
B	123.33 ± 6.09	123.34 ± 5.62	1.00	NS

Table 12a: Effect on systolic BP (Mean ± SD)

Group	Pre operative	Mean post operative (at 0,30, 60, 180 min)	P value	Significance
A	123.00 ± 6.03	123.15± 6.25	0.90	NS
B	123.33 ± 6.09	123.70 ± 6.05	0.81	NS

In both the groups there is no significant fall in systolic blood pressure in intra and post operative periods. (P > 0.05).

Table 13: Effect on diastolic BP (Mean ± SD)

Group	Pre operative	Mean Intraoperative	P value	Significance
A	77.07± 5.48	77.25 ± 4.89	0.34	NS
B	77.73± 6.05	77.93 ± 4.66	0.90	NS

Table 13a: Effect on diastolic BP (Mean ± SD)

Group	Pre operative	Mean post operative	P value	Significance
A	77.07 ± 5.48	77.45 ± 5.52	0.80	NS
B	77.73 ± 6.05	78.02 ± 4.72	0.85	NS

In both the groups there is no significant fall in diastolic blood pressure in the intra and post operative periods. (P> 0.05)

Table 14: Effect on respiratory rate (Mean ± SD)

Group	Pre operative	Mean Intraoperative	P value	Significance
A	14.73 ± 0.78	14.69 ± 0.78	0.81	NS
B	14.80 ± 0.71	14.81 ± 0.64	0.94	NS

Table 14a: Effect on respiratory rate (Mean ± SD)

Group	Pre operative	Mean post operative	P value	Significance
A	14.73 ± 0.78	14.62± 0.78	0.57	NS
B	14.80 ± 0.71	14.79± 0.73	0.93	NS

Table 14,14a shows the effect on respiratory rate in both the groups. The fall in respiratory rate in the intra and post operative period in both the groups is insignificant (P> 0.05)

Table 15: Effect on SPO2 (Mean ± SD)

Group	Pre operative	Mean Intraoperative	P value	Significance
A	99.80 ± 0.41	99.67 ± 0.20	0.11	NS
B	98.87 ± 0.35	99.75 ± 0.16	0.11	NS

Table 15 shows the effect on SPO2 in both the groups. There is no significant change in saturation in the intra operative period.

Discussion

Brachial plexus block is especially intended for the upper limb surgeries. Brachial plexus block avoids unwanted complications due to administration of various drugs in general anesthesia and upper airway instrumentation. There are various approaches to brachial plexus block, but the supraclavicular approach is the most common approach to brachial plexus because of compact arrangement of the nerve trunks. Longer acting local anaesthetics have been used for brachial plexus block. But still there are certain drawbacks that limits their extended use. These are: time taken to establish the block and inadequate post operative analgesia. Various studies have investigated several adjuncts that prolong the duration of analgesia [6].

Adjuvants are added to decrease the dose of local anesthetic and to improve quality and duration of analgesia. Adjuvants such as dexamethasone, tramadol are added to local anesthetics to improve the quality of nerve blocks.

Tramadol is an analgesic with mixed opioid and nonopioid activity. Tramadol seems to pass the neuronal membrane and diffuse within the interstitial or axonal fluid since it is a lipophilic drug [7]. The nonopioid activity is through alpha two agonist mechanism and serotonin and noradrenaline reuptake inhibition in central nervous system. It inhibits the reuptake of norepinephrine and serotonin from the nerve endings, and it is supposed to potentiate the effect of local anesthetics when mixed together.

In recent years dexamethasone has been studied as an adjuvant to local anaesthetic in peripheral nerve blocks. The mechanism of the analgesia induced by corticosteroids is not fully understood. This effect is suspected to be mediated by their anti-inflammatory or immune-suppressive effects [8, 9]. Steroids produce analgesia by blocking transmission in nociceptive c-fibres and suppressing ectopic neuronal discharge. Local application of methylprednisolone has been found to block transmission in c-fibres the effect was reversible, suggesting a direct membrane action of steroids. Steroids might bring about this effect by altering the function of potassium channels in the excitable cells. Some authors believe that analgesic properties of corticosteroids are the result of their systemic effect.

In the present study we compared the effects of Tramadol 2 mg/kg added to 0.5% bupivacaine and effects of dexamethasone 0.15 mg/kg added to 0.5% bupivacaine (2mg/kg) in supraclavicular brachial plexus block, in terms of onset and duration of sensory analgesia and motor block and side effects.

We used Bupivacaine in dose of 2mg/kg in this study as used by Shrestha BR *et al.* (2007) [10].

Tramadol was added in 2mg/kg dose in our study. Kapral S, *et al*. (1999) added tramadol in total dose of 100 mg and S. Mannion *et al.* (2004) used tramadol in dose of 1.5 mg/ kg as an adjunct [11, 12].

In present study, there was no significant difference in onset time. (p > 0.05) of motor block but onset of sensory block was significantly prolonged in Group. These results are consistent with the studies of Shrestha BR *et al.* (2007) [10].

Our study found that the total duration of analgesia following the brachial plexus block in the group B(1023.87±161.01) was significantly higher than in group A(454.4±44.29). The Duration of analgesia with Tramadol in brachial plexus block in the study by Chattopadhya, Mitra *et al.* was 410.1± 95.1 minutes.

Intensity of postoperative pain was evaluated using VAS. This study, similar to the study done by Madhusudhana, *et al*. [13] showed there is a significant decrease in VAS (intensity of pain) postoperatively when tramadol is added to local anesthetics during supraclavicular block.

Shrestha BR *et al.* (2007) also observed the degree of pain measured at first analgesic request was lower in Dexamethasone group in comparision to Tramadol group.

So our results are consistent with the previous studies. As told by Chattopadhya S *et al.* (2007) [14] duration of analgesia in Tramadol group was 410 ± 95.1 min, Vieira (2010) told that mean sensory block time in dexamethasone and bupivacaine group was 1457 min [15]. The present study showed a significant prolongation of sensory analgesia with addition of dexamethasone 0.15 mg/kg as compared to tramadol addition which result in less prolongation of analgesia.

In this study, there was no significant difference in the hemodyanamics parameters (Heart Rate, Blood Pressure and

SPO) between the two groups peri-operatively. Same observations were noted by Kapral S and Shah *et al.* [11, 16].

Conclusion

In conclusion, Dexamethasone with local anaesthetic prolongs postoperative analgesia significantly than Tramadol ($P<0.05$) when used as admixture to local anaesthetic in brachial plexus block in upper extremity surgery.

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