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Comparison of Tramadol & Dexamethasone as Adjuvants to Local Anaesthetic in Supraclavicular Brachial Plexus Block

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Abstract

Context: To assess the safety and efficacy of tramadol and dexamethasone as an adjuvant in enhancing post-operative analgesic effect of local anaesthetic in supraclavicular brachial plexus block (SCBPB). *Aims:* To compare the efficacy of tramadol and dexamethasone as adjuvants in SCBPB. *Material and method:* 40 patients belonging to ASA Class I and II, planned for elective upper limb surgery were randomly allocated in 2 groups of 20 each. They received SCBPB. Group T received 20 ml of 0.5% bupivacaine + 15 ml of 2% lignocaine + tramadol 100 mg while Group D received 20 ml of 0.5% bupivacaine + 15 ml of 2% lignocaine + dexamethasone 8 mg. Onset and duration of sensory and motor block, as well as duration of analgesia was observed. *Statistical analysis:* Unpaired t-test was used for statistical analysis on IBM Statistical Package for Social Sciences version 21. P-value significant if <0.05. *Results:* The onset of sensory & motor block was shorter, while duration was significantly prolonged in Group D than Group T. The duration of analgesia in group T was 502.5 ± 49.82 minutes and 989.75 ± 126.2 minutes in group D which was statistically highly significant (p<0.0001). *Conclusion:* It is concluded that dexamethasone when added to local anaesthetic in SCBPB enhances the onset of sensory, prolongs the duration of sensory and motor block and gives extensive duration of analgesia in the postoperative period with steady haemodynamics.

Keywords: Tramadol; Dexamethasone; Local Anaesthetics; Supraclavicular brachial plexus block.

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Introduction

Regional anaesthesia helps in removing the pain during the peri-operative period.

Brachial plexus nerve blocks with additives for upper limb surgeries provide superior analgesia, avoids side effects of general anaesthesia and minimises use of analgesics in the post-operative period [1,2].

Tramadol has a unique mechanism of action that suggests its efficacy as an adjunct to local anaesthetics in brachial plexus block.

Dexamethasone prolongs the peripheral nerve blockduration by its anti-inflammatory action.

Materials and Methods

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Anesthesiologist (ASA) I & II posted for elective surgeries on the lower arm, elbow and forearm were included in the present study after obtaining approval from the ethics committee and written & informed consent. Group T (n=20) received inj. bupivacaine 0.5% (20 ml) + inj. lignocaine 2% (15 ml) + inj. tramadol 100 mg (2 ml) and Group D (n=20) received inj. bupivacaine 0.5% (20 ml) + inj. lignocaine 2% (15 ml) + inj. dexamethasone 8 mg (2 ml) in supraclavicular brachial plexus block (SCBPB). Statistical analysis was done using student's t-test.

Inclusion Criteria

- Patients willing to sign the informed written consent.
- ASA grade I and II patients.
- Aged 18-60 years of either sex.
- Scheduled for surgeries on the upper limb under supraclavicular brachial plexus block

Exclusion Criteria

- Patient's refusal.
- ASA grade III and above.
- Patients with bleeding disorders.
- Patients with known hypersensitivity to local anaesthetics & adjuvants.
- Pregnant women.
- Pre-existing central and peripheral neuropathy.
- Patients with personality disorders.
- Local infection at injection site.

On arrival of the patients in the operating room, an 18-gauge intravenous (i.v.) line was secured in the unaffected limb and inj. Ringer's lactate was started at 10 ml kg^{-1}. The multipara monitor were attached to patients which includes pulse oximetry (SpO_2), Heart rate (HR), non-invasive blood pressure (NIBP) and electro cardiograph (ECG) monitoring. All patients were pre-medicated with inj. glycopyrrolate 0.2 mg i.v. The study drug was prepared by a senior anaesthesiologist who was not involved in the study. Patients were given supine position with head resting on ring and turned slightly to the contralateral side, ipsilateral arm adducted, shoulder depressed with sandbag placed in between scapula. Under aseptic precautions, SCBPB performed using nerve locator and stimulator. A distal motor response with an output lower than 0.7 mA was considered. After negative aspiration of blood, drug was injected and further each incremental injection of 5 ml to a total volume of 37 ml of drug solution was given. A brief massage for one minute was performed to facilitate an even drug distribution.

Onset of sensory block was assessed by the pin prick response [0=No block (normal sensation), 1=Partial block (decreased sensation), 2=Complete Block (no sensation)] on the areas of all four nerves (median, radial, ulnar & musculocutaneous nerve) of the upper limb. Duration of sensory block was taken as time interval in minutes from time when pin prick test was 2 to the time of first dose of rescue analgesia. Assessment of motor block was carried out using the Bromage three-point score (0= normal motor function with full flexion and extension of elbow, wrist and fingers, 1= decrease motor strength with ability to move fingers and/or wrist only, 2= complete motor blockade with inability to move fingers) by the same observer at every 5 minutes till complete motor blockade after drug injection. Onset time of motor block was taken as the time interval in minutes from time-0 till motor block started appearing i.e. Bromage scale score ≥ 1.

Time for complete motor block was taken as the duration of time in minutes from time-0 till complete motor block will be achieved i.e. BS score = 2. Thereafter effect of block was tested every 30 minutes.

Total duration of motor block was taken as the duration of time in minutes from the total complete motor block till the time when BS score < 2 in the postoperative period.

The block was considered to be incomplete when any of the segments supplied by the median, ulnar, radial and musculocutaneous nerve did not have analgesia after 30 minutes of drug injection. Block was considered as a failure if complete sensory and motor block was not achieved even after 45 minutes. Failed blocks were converted to general anaesthesia and were aborted from the study.

HR, systolic blood pressure (SBP), diastolic blood pressure (DBP) and SPO_2 were observed and recorded at 0, 5, 10, 15, 30, 45, 60, 120, 240, 360, 480, 600 and 720 minutes, any complications were monitored and treated accordingly.

Post-operative pain was assessed by Visual Analogue Scale (VAS) was assessed. VAS was recorded at an interval of every 2 hour till the score ≥ 4.

Table 1: Demographic Data

Variables	Group T (n=20)	Group D (n=20)	p value	Significance S- significant NS- not significant
Age (years) Mean ± SD	38.9 ± 9.94	40.55 ± 11.85	0.6361	NS
Weight (kg) Mean ± SD	52.15 ± 5.05	52 ± 5.03	0.9255	NS
Sex (M:F) Mean ± SD	13:7	13:7	1.0000	NS
Duration of Surgery Mean ± SD (minutes)/	79.65 ± 25.25	77.25 ± 25.67	0.7673	NS

Table 2: Onset & Duration of Sensory and Motor Block

Time (minutes)	Group T (n=30) Mean ± SD	Group D (n=30) Mean ± SD	p value	Significance
Onset of sensory block	19.35 ± 1.08	17.2 ± 0.95	<0.0001	S
Onset of motor block	13.05 ± 1.23	12.7 ± 0.93	0.3165	S
Duration of sensory block	431 ± 41.91	927.5 ± 127.85	<0.0001	S
Duration of motor block	347.5 ± 34.62	993.5 ± 129.95	<0.0001	S

Table 3: Post-Operative VAS

Time	Group T (n=20)	Group D (n=20)	P value	Significance
6 hrs	1.55 ± 1.50	0 ± 0.00	< 0.05	S
8 hrs	3.4 ± 1.90	0.6 ± 0.94	< 0.05	S
10 hrs	3.75 ± 1.68	1.6 ± 1.9	0.0005	S
12 hrs	2.35 ± 0.67	2.75 ± 2.26	0.4526	S

Table 4: Duration Time for Post-Operative Analgesia

Time	Group T (n=20)	Group D (n=20)	P value Significance
Duration Of Analgesia	502.5 ± 49.82	989.75 ± 126.2	<0.0001 S

Table 5: Post Operative Complications

Complications	Group T	Group D
Confusion	Nil	Nil
Auditory and Visual Disturbances	Nil	Nil
Arrhythmias	Nil	Nil
Convulsions	Nil	Nil
Sedation	Nil	Nil
Respiratory Depression	Nil	Nil
Pneumothorax	Nil	Nil
Haemorrhage	Nil	Nil

Results

Total 40 patients were allocated for the study. Both groups were comparable in respect to age, sex, weight and duration of surgery which is depicted in Table 1.

Discussion

Brachial plexus block acts as sole anaesthetic technique to provide painless upper limb surgery. Many approaches have been mentioned of which the classical supraclavicular approach is most common to brachial plexus for the whole upper limb surgeries because of compact arrangement of the nerve trunks. By adding various adjuvants it blocks all branches of brachial plexus [3]. Brachial plexus block technique provides best alternative to GA.

Tramadol inhibits the reuptake of nor-epinephrine and serotonin from the nerve

endings. It is supposed to potentiate the effect of local anaesthetics when mixed together [4].

Dexamethasone is a steroid. It has nerve block prolonging effects. They also have an action on potassium channels causing hyperpolarisation and blocking nerve conduction.

In present study we compared the effects of tramadol (100 mg) added to 0.5% bupivacaine + 2% lignocaine and effects of dexamethasone (8 mg) added to 0.5% bupivacaine + 2% lignocaine in SCBPB, in terms of onset and duration of sensory analgesia and motor block and side effects.

In this study the patients' characteristics (age, sex and weight) were similar in both groups. The average duration of the surgeries in both groups wasalso similar.

In this study 0.5% bupivacaine was used in 20 ml volume and 2% lignocaine was used in 15 ml volume. Tramadol was added in 2 ml (100 mg) volume in our study. Kapral S et al. added tramadol in total dose of 100 mg and S. Mannion et al. used tramadol in dose of 1.5 mg kg^{-1} as an adjuvant [5,6]. The dose of dexamethasone was 8 mg (2 ml). Ali movafegh et al., Shrestha BR et al., Sudha shah et al. and K C Cummings et al. used dexamethasone in dose of total 8 mg as an adjuvant [2,3,4,7].

Onset of Sensory and Motor Block: In our study onset of sensory block was significantly prolonged in Group T. These results are consistent with the studies of Shrestha BR et al. There was no significant difference in onset time of motor block ($p > 0.05$) but the onset of motor block was faster than the sensory block in either of the group in this study. As described by Winnie the outer motor fibres are blocked earlier than the sensory fibres which are situated deeper in the brachial plexus at the level of trunk and division [3]. Olfa Kabaachi noted that addition of tramadol was associated with some delay in onset [8,9]. Dan kopecz et al. concluded that onset time was reduced and the duration of analgesia increased on addition of dexamethasone [10].

Duration of Sensory and Motor Block: In this study we found that total duration forsensory block was 431 ± 41.91 minutes in group T and 927.5 ± 127.85 minutes in group D. P value is < 0.0001 which indicated that the difference in the time duration of sensory block in Group T versus Group D was statistically significant. The duration in Group D patients was longer for sensory block compared to Group T patients. The average duration for motor block was 347 ± 34.62 minutes in group T and 993 ± 129.95 minutes in group D. p value is < 0.0001 it suggest that the difference in the time duration of motor block in Group T versus Group D was statistically significant. The duration in Group D patients was longer for motor block compared to Group T patients. Similar to our study Shreshta B et al. had similar findings that when dexamethasone is added to local anaesthetic in brachial plexus block improves the speed of block onset and increases the duration of sensory block [3]. Ali movafegh et al. concluded that the addition of dexamethasone to lignocaine 1.5% lignocaine in brachial plexus block prolongs the duration of sensory and motor block [2].

Sudha shah et al. also had similar findings as compared to our study. In their tramadol group duration of motor block was 356.10 minutes while it was 513.17 minutes in their dexamethasone group. This difference of duration of motor block was found to be statistically significant ($p < 0.05$) [4].

Duration of post-operative Analgesia in both groups: The duration of post-operative analgesia was recorded in both groups using pain VAS score. The average duration for analgesia in Group T was 505.50 ± 49.82 minutes and 989.75 ± 126.2 minutes in group D. p value is < 0.0001 which clearly indicated that the difference in the time duration of analgesia in Group T versus Group D was statistically significant. The duration of analgesia in Group D patients was longer as compared to Group Tpatients.

Shreshta et al. conducted a study, comparison between tramadol and dexamethasone as adjuvant to 0.5% bupivacaine in supraclavicular block. In their study the duration of analgesia in dexamethasone group was 1028 minutes and 453 minutes in tramadol group, which is highly statistically significant ($p < .0001$). They concluded that dexamethasone with local anaesthetic drugs prolonged the post-operative analgesia significantly than tramadol [3].

Sudha shah et al. observed in their study that duration of analgesia in tramadol group was 454.47 minutes and in dexamethasone group was 1023.87 minutes. Which is highly significant ($p < 0.0001$) and indicated that dexamethasone added to local anaesthetic provides longer duration of analgesia comapared to tramadol added to local anaesthetics [4]. So our results were consistent with previous studies.

The only restriction in our study was that ultrasound guided supraclavicular brachial plexus block was not used by us which might have been beneficial in reducing the concentration and dose

of local anaesthetic.

Conclusion

From the present study, we concluded that dexamethasone (8 mg) added to local anaesthetic drugs (0.5% bupivacaine and 2% lignocaine) in SCBPB in upper limb surgeries is highly effective in onset of sensory block and prolongation of sensory block, motor block and better post-operative analgesia compare to tramadol (100 mg) without any side effects with steady haemodynamics.

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