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Comparitive Evaluation of Dexamtheasone and Tramadol as An Adjuvant to 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block

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Abstract

Aims and Objectives: The aim of the study is to compare and study the efficacy of dexamethasone *versus* tramadol when added as adjuvant to 0.5% ropivacaine in supraclavicular brachial plexus block for upper extremity surgeries. To compare the duration of postoperative analgesia with dexamethasone and tramadol added as an adjuvant to 0.5% Ropivacaine in supraclavicular brachial plexus block. To observe the side effects of the above two groups. *Materials and Methods:* All the patients were randomly allocated into two groups so that, each group consists of 30 patients of either sex in a given age range posted for elective upper extremity surgeries after obtaining consent from each of them. Group - RD: Injection Ropivacaine 0.5% (29 ml) + Injection dexamethasone 8 mg (2 ml) Group - RT: Injection Ropivacaine 0.5% (29 ml) + Injection tramadol 2 mg/kg. Hemodynamic variables and Visual Analog Scale (VAS) score was significantly were noted at regular intervals until the end of the surgery. *Results:* Onset of motor block was earlier in Group RD: (21.8 ± 1.57 min) as compared to Group RT: (25.1 ± 2.41 min). Onset of sensory block was earlier in Group RD: (16.63 ± 0.88 min) as compared to Group RT (17.43 ± 0.97 min). Total Duration of sensory block was lesser in Group RT (475.99 ± 31.24 mins) as compared to Group RD (580.00 ± 40.42 mins) *p* - value < 0.001. Total duration of motor block was lesser in Group RT(415.99 ± 31.24 mins) as compared to Group D (520.00 ± 40.42 mins) *p* - value < 0.001. Time to rescue analgesia was earlier in Group RT (580 mins) than in Group RD (816 mins). Duration of analgesia was longer in Group RD, as compared to Group RT. *Conclusion:* We observed that Group RD (Inj. 0.5% Ropivacaine + Inj. Dexamethasone 8 mg) has faster onset of sensory and motor blockade than RT (Inj. 0.5% Ropivacaine + Inj. Tramadol 2 mg/kg) when used in supraclavicular block in upper extremity surgeries. Duration of analgesia was greater with Dexamethasone when added as an adjuvant as compared to Tramadol and also Dexamethasone reduces the requirement of postoperative analgesia.

Keywords: Supraclavicular brachial plexus block; Dexamethasone; Tramadol.

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Introduction

The supraclavicular block is also called as the "spinal anesthesia of the upper extremity" because of its universal application for upper extremity surgery. This block can be given at the level of distal trunks which is limited to the smallest area of brachial plexus.[1] Temporary block of the sensation and movements of the upper extremity are achieved by injecting local anesthetics in close proximity to the brachial plexus.

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Brachial plexus block is less invasive and affects fewer organ systems than general anesthesia. Nerve stimulator or ultrasound guided blocks are superior than blind technique as they are accurate and several complications can be avoided that arise due to the blind technique.[2] Lignocaine and bupivacaine combinations or bupivacaine alone have been the commonly used drugs in brachial plexus block.[3] Ropivacaine is a long acting amide local anesthetic agent and first produced as a pure S enantiomer. Due to less lipophilic nature and steroeselectivity, ropivacaine has less cardiotoxicity and neurotoxicity than bupivicaine.

Dexamethasone is a derivative of synthetic glucocorticoid, which is a potent anti inflammatory, analgesic and immunosuppressive agent. It directly blocks the transmission in nociceptive C fibers by reducing the release of inflammatory mediators and up regulating the potassium channels. Perineural glucocorticoid is eventually absorbed and exerts systemic effects[4] and also influences postoperative analgesia.

Tramadol is an analgesic with μ mixed opioid and nonopioid activity. It acts by inhibiting the reuptake of both Norepinephrine (NE) and serotonin from the nerve endings and enhances the effect of local anesthetics when used together in peripheral regional nerve block. It has less respiratory depressant effect due to weak μ-receptor affinity.[5] Hence, the present study was to compare the efficacy of sensory and motor onset of dexamethasone *versus* tramadol as an adjuvant to 0.5% ropivacaine in supraclavicular brachial plexus block. The duration and quality of sensory and motor blockade and postoperative analgesia was studied and any associated complications and side effects were noted.

Materials and Methods

Institute Ethics committee (ICS) clearance was obtained prior to commencement of study. 60 patients undergoing elective upper limb surgeries under supraclavicular block were selected randomly after applying the already mentioned stringent inclusion and exclusion criteria.

All the patients were divided into 2 Groups, Group RD and RT. An informed consent was taken for every case selected for the study. Using computer generated random allocation chart, patients were randomly allocated to one of the Two Groups according to the drug to be used.

Place of study was at DY Patil, Medical College, Hospital and Research Centre. Pimpri, Pune 411018.

Brachial plexus block was carried out on patients undergoing elective upper limb surgery. 60 patients were divided into 2 groups of 30 each, group RD (ropivacaine with dexamethasone) and Group RT (Ropivacaine with tramadol). Each Group was given their respective drug as per to a double blind method. The drug was prepared by an anesthesiologist who was not involved in the administration of anesthesia, patient care or data collection.

Group RD - Injection Ropivacaine (0.5) 28 ml + Injection Dexamethasone 8 mg;

Group RT - Injection Ropivacaine (0.5%) 28 ml + Injection Tramadol 2 mg/kg.

All the patients were subjected to thorough preoperative evaluation and relevant laboratory investigations. All patients were kept fasting 8 hours prior to surgery. On arrival to the operating room NBM status and consent was checked. Basic monitoring equipment (pulse oximeter, NIBP, ECG monitor) was connected. Baseline vital parameters were recorded. An intravenous line was secured using 20G IV cannula in the arm not being operated. All patients were made to lie supine. Head was rotated to the other side. Ipsilateral arm was extended and shoulder depressed. A small bolster was placed between the shoulder blades to make the plexus taut. Supraclavicular brachial plexus block was performed under all aseptic precautions. A nerve stimulator with 22G, 5 cm insulated needle will be used for precise location of brachial plexus.

A skin wheal raised in the supraclavicular region, 1 cm above the medial two third and the lateral one third of the clavicle. Subclavian artery is usually palpated on this site. Nerve stimulator frequency was set at 2 Hz and intensity of stimulating current was initially set to deliver 1 mA for 0.1 ms. Insulated needle was inserted through the skin wheal in a posterior, caudal and medial direction until a distal motor response is elicited. As the nerve was approached, movement of the wrist or fingers was identified and the current was gradually reduced to 0.5 mA. Position of needle is considered acceptable when an output current 0.5 mA elicits a distal motor response. At this point after negative aspiration for blood, a mixture of local anesthetic, Inj. Ropivacaine 0.5% and adjuvant either with Inj. Dexamethasone 8 mg or Inj. Tramadol 2 mg/kg as per the group allotted were given in incremental doses.

Completion of injection will be considered as T0. Sensory and motor blockade evaluation should was calculated every 2 min until complete sensory or motor block or till 30 min whichever was earlier.

Assessment of sensory block: Onset of sensory block was evaluated by pin prick sensation. Dull sensation on pin prick which was compared with the other arm, was taken as the time of onset of sensory blockade.

Assessment of motor block: the motor block was assessed with the help of modified bromage scale.

Onset of motor blockade, was considered from the injection of drug upto the time when patient felt heaviness on abduction of arm, at shoulder or on achieving bromage scale where:

0- Able to raise the extended arm to 90 degree for a full 30 seconds;

1- Able flex the elbow and move the fingers but unable to raise the extended arm;

2- Unable to flex the elbow but able to move the fingers;

3- Unable to move the arm, elbow or fingers.

Duration of analgesia: Was taken from the time of administration of drug to the time of giving first rescue analgesia. Postoperative rescue analgesia with Inj. Diclofenac sodium 75 mg IM was given if the complaints of moderate pain (VAS > 4). The patients were taught to assess the intensity of pain using visual analog scale (VAS) for postoperative pain assesement.

All patients were educated regarding the use of VAS (Visual Analog Scale), in which 0 means no pain and 10 means worst pain.

Following recordings were made:

T0 : Time of administration of drug;

T1: Time of onset of sensory response;

T2 : Time of onset of motor response;

T3 : Total duration of sensory block - return of pin prick sensation (minutes);

T4 : Total duration of motor block-return of motor effect (minutes);

T5 : Duration of analgesia is time of first rescue analgesia (minutes).

Side effects: Like nausea, vomiting, bradycardia, hypotension, and complications of supraclavicular block like respiratory distress due to pneumothroax, etc. were noted in the intraoperaitve and postoperative period and treated accordingly.

Data was collected within the stipulated period of time. The statistical analysis was done using parametric test and final interpretation will be based on "Z test" (standard normal variant) with 95% level of significance. Qualitative data was analyzed by Chi-square test, for establishing any association between the parameters under study.

Results

The demographic variables such as age, weight, gender and ASA grading were comparable in both the groups.

In this study, Onset of sensory block was earlier in Group RD: (16.63 $\pm$ 0.88 min) as compared to Group RT (17.43 $\pm$ 0.97 min). Onset of motor block was earlier in Group RD: (21.8 $\pm$ 1.57 min) as compared to Group RT: (25.1 $\pm$ 2.41 min) (Table 1).

Total Duration of sensory block was lesser in Group RT (475.99 $\pm$ 31.24 mins) as compared to Group RD (580.00 $\pm$ 40.42 mins) p - value < 0.001. Total duration of motor block was lesser in Group RT (415.99 $\pm$ 31.24 mins) as compared to Group RD (520.00 $\pm$ 40.42 mins) p - value < 0.001 (Table 2).

Time to rescue analgesia was earlier in Group RT (580 mins) than in Group RD (816 mins). Duration of analgesia was longer in Group RD, as compared to Group RT (Tables 3–6 and Fig. 1).

Table 1: Comparison of T1 and T2 in study groups

Onset of Block in mins	Group	Mean	SD	*t* - Test Value	*p* - Value
T1 (Sensory onset)	RT	17.4333	0.97143	3.32	0.02
	RD	16.6333	0.88992		
T2 (Motor onset)	RT	25.1	2.41	3	< 0.0001
	RD	21.8	1.57		

Table 2: Comparison of T3 and T4

Total duration of Block in mins minutes	Group	Mean	SD	*t* - Test Value	*p* - Value
Motor	RT	415.998	31.2498	-11.43	< 0.001
	RD	520.002	40.4286		
Sensory	RT	475.998	31.2498	-11.34	< 0.001
	RD	580.002	40.4286		

Table 3: Time for Rescue analgesia (T5)

Group	*n*	Mean	SD	*t* - Test Value	*p* - Value
RT	30	580.002	53.0454	-15.25	< 0.001
RD	30	816	66.1032		

Table 4: Heart rate wise distribution between RT group and the RD group

Heart Rate	Group	Mean	SD	*t* - Test Value	*p* - Value
Baseline	RT	78.5333	2.40306	-1.43	0.16
	RD	79.4667	2.72578		
Giving drug	RT	78.0000	2.40689	-2.256	0.10
	RD	79.4667	2.72578		
After 5 mins	RT	77.6667	2.10637	-0.865	0.39
	RD	78.2000	2.64445		
After 15 mins	RT	77.6667	2.10637	-0.834	0.10
	RD	78.2000	2.64445		
After 30 mins	RT	77.7000	2.81805	-1.34	0.33
	RD	78.6667	2.74595		
After 60 mins	RT	77.1667	3.58236	-1.23	0.18
	RD	78.7333	2.85190		
After end of surgery mins	RT	78.5000	2.52914	-1.45	0.12
	RD	79.2667	2.8031		

Table 5: MAP wise distribution between Tramadol group and the Dexamethasone group

Mean Arterial Blood Pressure	Group	Mean	SD	*t* - Test	*p* - Value
Baseline	RT	126.4667	4.46408	0.85	0.38
	RD	125.4667	4.46408		
Giving drug	RT	97.0889	3.58577	1.124	0.11
	RD	95.5889	3.58577		
After 5 mins	RT	96.6444	2.40359	2.42	0.09
	RD	95.1444	2.40359		
After 15 mins	RT	86.7333	3.12866	1.234	0.22
	RD	85.7333	3.12866		
After 30 mins	RT	81.7111	3.31574	1.453	0.16
	RD	80.5111	3.31574		
After 60 mins	RT	97.1556	3.23739	1.564	0.12
	RD	95.8556	3.23739		
After end of surgery mins	RT	115.545	3.2345	0.784	0.15
	RD	114.545	3.2335		

Table 6: SpO_2 wise distribution between Tramadol group and the Dexamethasone group

SpO_2	Group	Mean	SD	*t* – Test Value	*p* - Value
Baseline	RT	99.43	.898	701	.486
	RD	99.27	.944		
Giving drug	RT	99.77	.568	0.00	1.000
	RD	99.27	.504		
After 5 mins	RT	99.73	.583	-.482	.632
	RD	99.80	.484		
After 15 mins	RT	99.57	.774	-.979	.332
	RD	99.73	.521		
After 30 mins	RT	99.63	.809	-1.008	.317
	RD	99.80	.407		
After 60 mins	RT	99.77	.568	-.823	.414
	RD	99.47	.346		
After end of surgery mins	RT	99.97	.568	-.245	.808
	RD	99.80	.484		

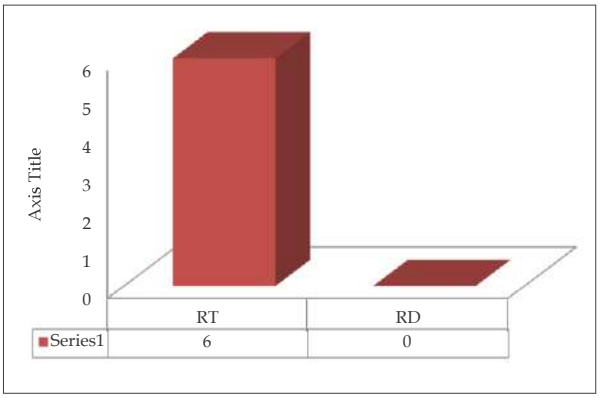

Fig. 1: Comparison of incidence of side effects in both the groups

Discussion

The supraclavicular approach to the brachial plexus characteristically is associated with a brisk onset of anesthesia and is highly successful. It is ideal for procedures of the arm, forearm and hand. The brachial plexus is most concise at the level of C5-T1 nerve roots and therefore blockade at this level is of utmost importance.

Supraclavicular nerve block with local anesthetics can provide superior anesthesia of the upper extremities. Advantages of supraclavicular nerve block:

- Technically easy to perform;
- Complete block is achieved without sparing of nerves;
- Outstanding regional anesthesia and muscle

relaxation for surgery and for providing long-term postoperative analgesia;

- Maintains hemodynamics;
- Good for patients who are at high-risk for general anesthesia, or not adequately nil by mouth;
- Early ambulation in postoperative period is possible.

The extent and duration of the block can be customized to meet the needs required by the type of surgery and the patient´s condition, by selecting, the Local Anesthetic (LA), and the use of either a single shot or a continuous technique.

The ability to administer this block with precision has become possible with the advent of ultrasound, peripheral nerve stimulator, echogenic needles and depth coded needles. Historically, peripheral nerve blocks were administered using a technique that elicited paresthesia on needle contact with a nerve. Nerve stimulation is appreciated for its objectivity and the fact that there is no need for patient reporting of paresthesia. Using this technique, it becomes easy to precisely locate peripheral nerves based on nerve twitch response. Now-a-days, ultrasound guidance for peripheral nerve blockade is gaining popularity, due to greater success rates and fewer complications.

In the current study, identical volumes and concentrations were used. In Group RD, Inj. Ropivacaine 29 ml (0.5%) with dexamethasone 8 mg (2 ml) was used and in Group RT, Inj. Ropivacaine 29 ml (0.5%) with Tramadol 2 mg/kg was used. Recommended dose of Ropivacaine in supraclavicular brachial plexus block is 3 mg/kg body weight. The maximum allowable toxic dose of Ropivacaine in an adult is 300 mg.

Studies contrasting intense danger of ropivacaine with bupivacaine found that ropivacaine was at least 25% less lethal than bupivacaine. In numerous examinations, greatest portion of ropivacaine up to 5 mg/kg was accounted for to be sheltered with no dangerous impact.

Be that as it may, Geiger and associates[6] detailed safe utilization of 1% ropivacaine up to 500 mg.

Hickey et al.[7], did a comparative study with 0.25% ropivacaine and 0.25% bupivacaine for supraclavicular block and evaluated that the 0.25% concentration for brachial plexus block is not sufficient to achieve surgical anesthesia because of a slow onset and a high-rate of inadequate block.

Onset of sensory block was evaluated by pin prick sensation. Dull sensation on pin prick, which was compared with the other arm, was taken as the time of onset of sensory blockade. Onset of sensory block was earlier in patients given Group RD (16.6 ± 0.88 mins) than in Group RT (17.4 ± 0.97 mins). On comparing the onset time of sensory block in the Two Groups, the *p* - value was 0.02 which was statistically highly significant (*p* - < 0.001).

In 2015, Jigisha Prahladrai[8], Rashida M et al., conducted a randomized double blinded study in patients posted for upper limb orthopedic surgery who underwent Supraclavicular brachial plexus block. Their study compared equal volumes (30 ml) of 0.5% bupivacaine and 0.5% ropivacaine. 0.5% ropivacaine provided significant earlier onset of sensory block 9.5 ± 2 min as compared to 0.5 % bupivacaine 7.46 ± 2.54 min.

In 2007, Shrestha[9] et al. compared tramadol and dexamethasone as an adjuvant to bupivacaine for supraclavicular brachial plexus block using surface landmark technique and showed the mean onset time for sensory blockade in Tramadol Group were 18.47 min and for Dexamethasone Group was 16.76 min.

Onset of motor blockade, was considered from the injection of drug upto the time when patient felt heaviness on abduction of arm, at shoulder or on achieving bromage scale 1. The onset of motor block was earlier with Group RD (21.8 ± 1.57 mins) than with RT (25.1 ± 2.41 mins). On comparing the onset time of motor block among the Two Groups, the *p* - value < 0.001, which was statistically significant, (*p* < 0.05).

In 2015, Prerana P Mankad[10], Jayendra C Makwana, did a comparative study of 0.5% ropivacaine and 0.5% levobupivacaine in supraclavicular brachial plexus block. The motor onset was considerably quicker with 0.5% ropivacaine (9.50 ± 2.403 min) when compared with 0.5% levobupivacaine (12.33 ± 2.537 min; *p* < 0.05).

In 2019, Kataria AP, Mohan B, Singh L[11] did a study to evaluate and compare tramadol and dexamethasone as an adjuvant to levobupivacaine in supraclavicular block and found out that the onset of motor block was earlier in study group of dexamethasone having the mean value of (7.93 ± 0.73 min) and in comparison, the control group had a mean value of (9.00 ± 1.33 min), which is statistically significant (*p* > 0.05).

Total duration of sensory block was taken as the time interval between sensory block and re appearance of pin prick response. The patients either started feeling either touch sensation on pin prick or slight pain.

Duration of sensory blockade is considerably less in RT (475.99 ± 31.24 mins) compared to RD (580.00 ± 40.42 mins). The data between the two groups was compared and found to be highly significant (p - value < 0.001).

In 2013, Prashant A Biradar[12], Padmanabha Kaimar, and Kannappady Gopalakrishna performed a prospective, randomized, double-blind study to evaluate the effect of dexamethasone added to lidocaine (1.5%) *versus* lignocaine (1.5%) and adrenaline (1:2,00,000) and concluded that addition of dexamethasone 8 mg in supraclavicular brachial plexus block prolongs the duration of sensory block (326 ± 58.6 *vs* 159 ± 20.1) as in compared to the control group. (p = 0.001).

The Total duration of motor block was calculated as the time from the onset of motor block to complete recovery of movement of the hand.

Duration of motor blockade was lesser in Group RT (475.99 ± 31.24 mins) than in Group RD (580.002 ± 40.42 mins). Duration of motor blockade (mins) of the two groups was analyzed statistically (p < 0.001) and found to be significant (p < 0.05).

In 2017, Raj SA[13], Singh DR, Charles SA, et al. evaluated the efficacy of tramadol or dexamethasone as an adjuvant to levobupivacaine in ultrasoundguided supraclavicular brachial plexus block in terms of complete duration of motor blockade. In Group T was 764.63 min and for Group D was 1150.27 min which was statistically significant (p < 0.05). Therefore, most of the studies suggested that time taken for motor blockade was lesser in groups receiving Tramadol when compared to Dexamethasone as adjuvants.

Duration of analgesia was taken from the time of administration of drug to the time of giving first rescue analgesia. Rescue analgesia was given when VAS score was 4 or more.

The results of this study, demonstrated that a supraclavicular nerve block in Group RD provides longer postoperative analgesia (816 ± 66 minutes) than in Group RT (580 ± 53 mins).

In 2018, Chandrashekar[14] did a comparative study between tramadol and dexamethasone with bupivacaine when added as an adjuvant in supraclavicular brachial plexus block and concluded that the mean duration of postoperative analgesia was prolonged with dexamethasone group (1023.87 ± 161.01 mins) compared to that with tramadol group (454.47 ± 44.29 mins).

There was no significant fall or rise in Mean arterial pressure and heart rate within groups after administration of drug, or after 5, 10, 15 and 30 minutes, 1 hour and at the end of the surgery. Incidence of side effects like nausea an pronounced in 6 patients in the Group RT and were minimum with Group RD, there was no incidence of significant complications (intraoperative and postoperative) such as pneumothorax, intravascular injection of the drug, cardiotoxicity, or neurotoxicity in either group.

There were certain limitations in this study also. The sample size was small for the study, so, further studies have to be carried out. There was no ultrasound machine availability and recent studies show that accuracy of the block is improved on using an ultrasound combined nerve stimulation technique for nerve location. The patients who had a failed block or inadequate block were given general anesthesia and were excluded from the study.

Conclusion

To conclude the study, we observed that Group RD (Inj. 0.5% Ropivacaine + Inj. Dexamethasone 8 mg) has faster onset of sensory and motor blockade than RT (Inj. 0.5% Ropivacaine + Inj. Tramadol 2 mg/kg) when used in supraclavicular block in upper extremity surgeries.

Duration of analgesia was greater with Dexamethasone when added as an adjuvant as compared to Tramadol and also Dexamethasone reduces the requirement of postoperative analgesia.

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