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"A COMPARATIVE STUDY BETWEEN DEXAMETHASONE AND TRAMADOL AS AN ADJUVANT TO 0.5% ROPIVACAINE IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES"

Anaesthesiology

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ABSTRACT

Background: Pain is the most agonizing entity to the patient in post-operative period. Brachail plexus block is the most common anaesthetic technique for upper limb surgeries and an excellent alternative to general anaesthesia. Various adjuvants are used with local anaesthestics like opoids, clonidine , dexamethasone, and dexmedetomidine etc. In our study we compare the effects of dexamethasone and tramadol added as adjuvants to 0.5% ropivacaine.

Objectives:

1. 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 limb surgeries .
2. To compare the duration of post operative analgesia with dexamethasone and tramadol added as an adjuvant to 0.5% Ropivacaine in supraclavicular brachial plexus block
3. To observe the side effects of the above two groups.

Methodology: After fulfilling the inclusion criteria and signing the informed consent Brachial plexus block was done under ultrasound guidance on patients undergoing elective upper limb surgery. 60 patients were divided into 2 groups of 30 each, Group RD- injection ropivacaine (0.5) 28ml +injection dexamethasone 8mg Group RT-Injection ropivacaine (0.5%)28ml+ injection tramadol 2mg/kg. **Results:** Total Duration of sensory block was lesser in Group RT(475.99+ 31.24mins) as compared to Group RD (580.00+40.42mins) P value <0.001 Total duration of motor block was lesser in Group RT(415.99+31.24mins) as compared to Group RD(520.00+40.42mins). P value <0.001 Duration of both sensory and motor blockade (mins) between the two groups was analyzed statistically and found to be significant (P<0.05). Incidence of side effects like nausea was more pronounced in 6 patients in the group RT and was nil in group RD. No patient had respiratory depression, bradycardia, hypotension. Side effects seen in both the groups were not statistically significant. (P value>0.05) **Conclusion:** We conclude that group RD (Inj 0.5% Ropivacaine+ Inj. Dexamethasone 8mg) has faster onset of sensory and motor blockade than RT(Inj 0.5% Ropivacaine+ Inj Tramadol 2mg/kg) when used in ultrasound guided supraclavicular block in upper limb surgeries. Duration of analgesia was greater with Dexamethasone when added as an adjuvant as compared to Tramadol and also Dexamethasone reduces the requirement of post operative analgesia with nil side effects.

KEYWORDS

Ultrasound guided, Ropivacaine, Dexamethasone, Tramadol, supraclavicular Brachial plexus block

INTRODUCTION

The supraclavicular block is also called as the "spinal anaesthesia 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] .The entire motor, sensory and sympathetic innervation of the upper extremity is carried by the trunks except the proximal most part of the medial arm. Temporary block of the sensation and movements of the upper extremity are achieved by injecting local anesthetics in close proximity to the brachial plexus.

Brachial plexus block is less invasive and affects fewer organ systems than general anaesthesia. 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] . However lignocaine has very short duration of action and bupivicaine has cardiotoxic and neurotoxic potential. Ropivacaine is a long acting amide local anaesthetic agent and first produced as a pure s enantiomer. Due to less lipophilic nature and steroeselectivity, ropivacaine has less cardiotoxicity and neurotoxicity than bupivicaine.

Various adjuvants like opioids, clonidine, dexmeditomedine are added in peripheral nerve blocks to increase duration of action, speed of onset improve quality of the block and to reduce toxicity of local anaesthetics. However these are associated with side effects like heavy sedation and respiratory depression. Therefore drugs with minimal side effects are always looked for.

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 post operative analgesia.

Tramadol is an analgesic with μ mixed opioid and non opioid activity. It acts by inhibiting the reuptake of both Nor epinephrine (NE) and serotonin from the nerve endings and enhances the effect of local anaesthetics when used together in peripheral regional nerve block. It has less respiratory depressant effect due to weak μ receptor affinity[5].

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 under ultrasound guidance. The duration and quality of sensory and motor blockade and post operative analgesia was studied and any associated complications and side effects were noted.

METHODOLOGY

The study population consist of 60 cases posted for upper limb surgeries at Basaveshwara Teaching and General Hospital, Kalaburagi, After getting approval from the institutional ethical committee and after obtaining written informed consent from each patient ,the study was conducted.

Type of study :- Prospective randomized study
Period of study :- July 2021 to December 2022
Period required for data collection :-1.5yrs
Period required for data analysis and reporting :-1 month.
Sample size:-60 cases

- Group RD- 30cases.(Inj Ropivacaine(0.5%) 28ml+inj

dexamethasone 8mg)
- Group RT- 30 cases (Inj Ropivacaine(0.5%) 28ml+inj tramadol 2mg/kg)

All the patients were divided into 2 groups, group RD and RT.

An informed consent was taken for every case selected for the study.

Place of study: Basaveshwar Teaching & General Hospital affliated with MRMC, Kalaburgi

Inclusion Criteria:
1.ASA grade I or II of either sex
2. Ages between 18 to 60 years of either sex
3. Patients undergoing elective upper limb surgeries.

Exclusion Criteria:
1. Patient refusal
2. Patients with ASA physical status III or more.
3. Non cooperative patient.
4.Patients on any opioid or any sedative medication in the week prior to the surgery.
5.Pregnancy
6. Patients who have known allergies to any of test drugs.
7. Patients with coagulation disorders or on anti coagulant drugs.

ANAESTHETIC PROCEDURE
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 I.V cannula in the arm not being operated. All patients were made to lie supine. Head was rotated to the other side. Operating arm was extended and shoulder was depressed. Under Ultrasound guidance Supraclavicular brachial plexus block was performed with all aseptic precautions.

After placing the linear transducer probe above the clavicle, cross sectional view of subclavian artery was Identified & confirmed with colour doppler, the brachial plexus identified as hypoechoic oval structures posterior & superficial to the artery . A skin wheal raised 1cm lateral to the transducer using 23G needle with 1ml- 2ml of local anaesthetic drug . Group RD cases were injected with 28ml of 0.5% of inj. Ropivacaine with 8mg of inj. Dexamethasone around the plexus and Group RT received 28ml of 0.5% inj.ropivacaine with 2mg/kg of tramadol around the plexus, after negative aspiration for blood.

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 was achieved.

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.

Post operative rescue analgesia with Injdiclofenac sodium 75mg I.M 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 post operative 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.

It is a 10 cm line on a white paper and represents patient's degree of perception of pain. Depiction of VAS will be explained to patients pre operatively. Patient will rate the degree of pain by making a mark on the linear scale. Score will be measured by taking the distance from 0 to the patients marked point.

0- No pain, 0-3 Mild pain, 3-7 Moderate pain,
>7 Severe pain,10- Maximum pain

VAS was monitored every hourly in the post operative period. Rescue analgesia was given when VAS is 4 or more.

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 intra operaitve and post operative period and treated accordingly.

Statistical Methods:
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 analysed by chi square test, for establishing any association between the parameters under study.

OBSERVATION AND RESULTS
GROUP RD: Inj Ropivacaine 0.5%+ Inj Dexamethasone 8mg
GROUP RT: Inj Ropivacaine 0.5%+ Inj Tramadol 2mg/kg.

Demographic Profile
Table 1: Age Wise Distribution Of Cases Between Study Groups

GROUP	N	MEAN	SD	T TEST VALUE	P VALUE
RT	30	36.45	10.15	-663	5.10
RD	30	38.53	10.98		

The mean age of the participants in the RT group is 36.45 & the mean age group of the participants in the RD group is 38,53. The p value of the difference in means between the two groups in 5.10, since this is > then 0.05, we can conclude that the mean age of the two groups is not statistically significant.

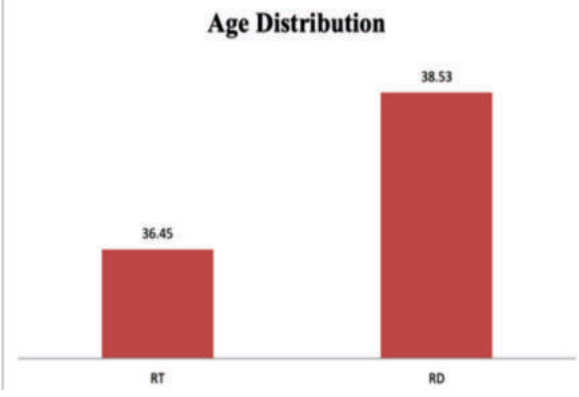


Table 2: Gender Distribution In Between Study Groups

Gender	RT	RD	Chi value square	P value
Male	16	18	0.60	0.79
Female	14	12		
Total	30	30		

In Group RT, out of 30 patients, 16 were male and 14 were female.
In Group RD, out of 30 patients, 18 were male and 12 were female.

The gender wise distribution amoung both the group is as shown in the graph, with p value being 0.79 (>0.05), indicating the gender wise distribution between both the groups is not statistically significant.

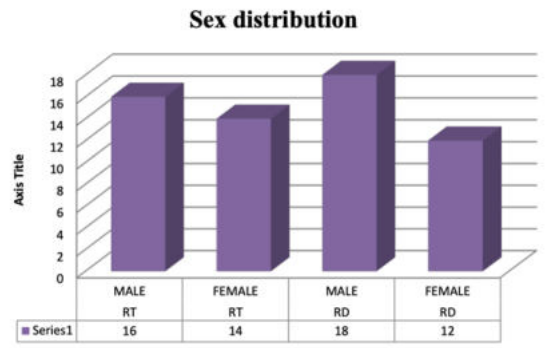


Table 3: Comparison Of Weight Among The Study Groups

GROUP	N	MEAN	SD	T TEST VALUE	P VALUE
RT	30	57.60	7.295	2.001	0.062
RD	30	54.27	5.477		

The mean weight of the participants in the RT group is 57.6 and the mean age group of the participants in the RD group is 54.27. The p value of the difference in means between the two groups in 0.06, since this is > then 0.05, we can conclude that the mean weight of the two groups is not statistically significant.

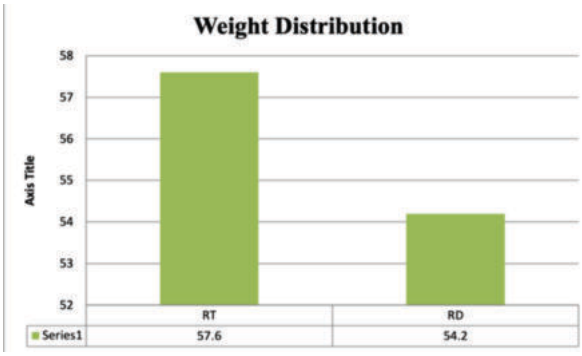


Table 4: ASA Grading Distribution Between The Cases In Study Groups

ASA Grade	RT	RD	Chi value square	P Value
ASA I	18	19	0.71	0.791
ASA II	12	11		
Total	30	30		

In group RD, there were 19 ASA I patients and 11 ASA II patients.
In group RT, there were 18 ASA I patients and 12 ASA II patients.

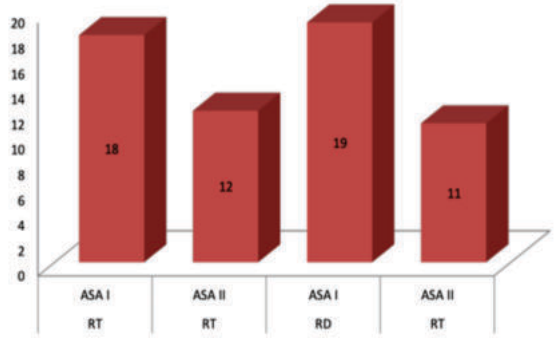


Table 5: Comparison of T1 and T2 In Study Groups

Onset of Block in mins	GROUP	MEAN	SD	T TEST	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		

Onset of sensory and motor block were compared applying "Z test of proportion" and showed statistically significant difference.

T1: Onset of sensory block was earlier in Group RD: (16.63+ 0.88 min) as compared to Group RT (17.43+0.97 min).
T2: Onset of motor block was earlier in Group RD: (21.8+ 1.57 min) as compared to Group RT: (25.1+ 2.41min).

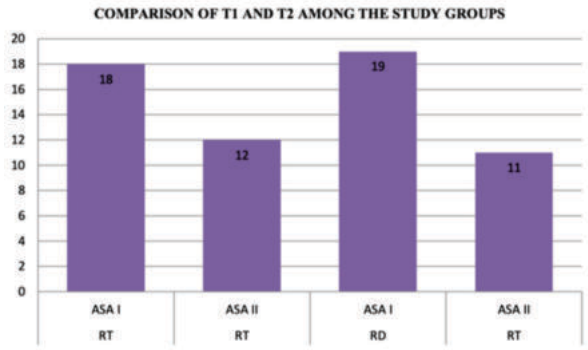


Table 6: Comparison T3 & T4

Total duration of Block in minutes	GROUP	MEAN	SD	T Test	P VALUE
Motor	RT	415.998	31.2498	-11.34	<0.001
	RD	520.002	40.4286		
Sensory	RT	475.998	31.2498		
	RD	580.002	40.4286		

Total Duration of sensory block was lesser in Group RT(475.99+ 31.24mins) as compared to Group RD (580.00+40.42mins) P value <0.001.

Total duration of motor block was lesser in Group RT(415.99+31.24mins) as compared to Group RD(520.00+40.42mins). P value <0.001

Duration of both sensory and motor blockade (mins) between the two groups was analyzed statistically and found to be significant (P<0.05).

Multiple bar diagrams showing the comparsion of T3 and T4 groups

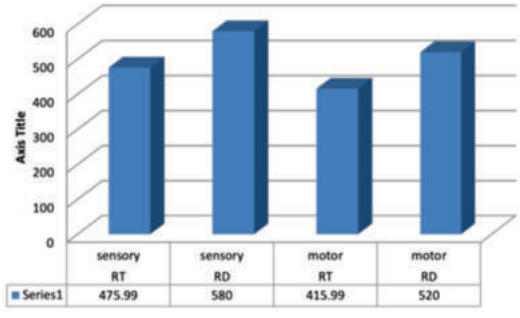
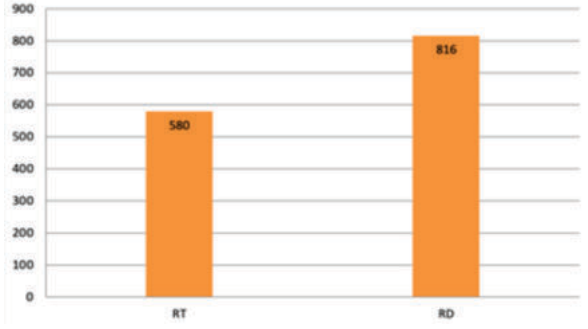


Table 7: Time for Resuce Analgesia (T5)

GROUP	N	MEAN	SD	T TEST VALUE	P VALUE
RT	30	580.002	53.0454	-15.25	<0.001
RD	30	816	66.1032		

Multiple bar diagram showing comparison of T5 in study groups

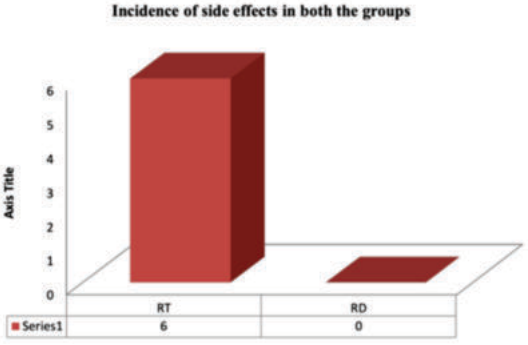


Time to rescue analgesia was earlier in Group RT (580mins) than in Group RD (816mins). Duration of analgesia was longer in Group RD, as compared to Group RT. The Z value was statistically significant (P<0.05).

Table 8 : Side Effects Distribution Between RT Group And The RD Group

S/E	Tramadol	Dexamethasone
Nausea	6 (20%)	0

Comparison of side effects: Incidence of side effects like nausea was more pronounced in 6 patients in the group RT and was nil in group RD. No patient had respiratory depression, bradycardia, hypotension. Side effects seen in both the groups were not statistically significant. (P value>0.05)



DISCUSSION

The ultrasound guided supraclavicular approach to the brachial plexus is associated with a brisk onset of anaesthesia 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 anaesthesia 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 post-operative 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 . Nowadays, ultrasound guidance for peripheral nerve blockade is gaining popularity, due to greater success rates and fewer complications.

Peripheral nerve blockade requires a high volume of local anesthetic for a successful blockade. This increases the risk of local anesthetic toxicity through accidental intravascular injection of local anesthetics. This has lead to the search for local anesthetics with improved safety profile and introduction of Ropivacaine like into market .

In the search of a better alternative, Ropivacaine has been proposed as a promising drug with fewer cardiovascular and central nervous system side effects compared to that of Bupivacaine Being an amino-amide LA and S-enantiomer of S-1-propyl2,6pipecoloxylidide structure is similar to that of bupivacaine.

Addition of adjuvants to local anaesthetics improves the quality of anaesthesia and prolongs the analgesia .

Recently, dexamethasone has been extensively studied as a local anesthetic adjuvant for peripheral nerve block .Dexamethasone is a long acting, high potency synthetic analogue of glucocorticoids and is primarily used for its anti-inflammatory effects in disorders of many organ systems. In addition to binding specific nuclear steroid receptors, it interferes with nuclear factor kappa B pathway activation. For postoperative nausea and vomiting dexamethasone is universally accepted and is effective also. The analgesic and antiemetic actions are due to anti- inflammatory property of Dexamethasone.

Tramadol, a synthetic 4-phenyl-piperidine analog of codeine and a synthetic opioid selective for mu receptors. Its monoaminergic activity inhibits nociceptive transmission by augmenting the inhibitory activity of descending pain pathways. Several studies have suggested that tramadol has peripheral local anaesthetic effects with minimal sedation and no cardiovascular compromise.The mechanism of action is by causing an axonal block by acting on voltage – dependent sodium channels, thus altering the sensory and motor nerve conduction.

The present study was carried out to compare and study the efficacy of dexamethasone(8mg)versus tramadol when added as an adjuvant to 0.5% ropivacaine in ultrasound guided supraclavicular plexus block for upper extremity .

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.

CONCLUSION

The brachial plexus block via the spraclavicular approach instinctively is associated with brisk onset of anaesthesia and highly successful. It is great for procedures of the arm, forearm and hand. Ropivacaine is a less cardio toxic, neuro toxic local anaesthetic and equally potent with Bupivacaine in peripheral nerve blockade.

To conclude the study, we observed that group RD (Inj 0.5% Ropivacaine+ Inj. Dexamethasone 8mg) has faster onset of sensory and motor blockade than RT(Inj 0.5% Ropivacaine+ Inj Tramadol 2mg/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 post operative analgesia.

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