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COMPARATIVE STUDY BETWEEN 0.25% BUPIVACAINE WITH 8 M.G DEXAMETHASONE AND 0.25% BUPIVACAINE WITH 50µg DEXMEDETOMIDINE AS AN ADJUVANT FOR INTERSCALENE BRACHIAL PLEXUS BLOCK: PROSPECTIVE CLINICAL STUDY

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ABSTRACT: INTRODUCTION: Adding adjuvant to local anesthetics for peripheral nerve blocks may enhance the duration of anesthesia and analgesia. Adding adjuvant to local anesthetics is practiced widely to decrease the dose of postoperative opioid analgesic and to decrease postoperative incidence of vomiting. **AIMS AND OBJECTIVES:** The aim of the study was to compare the safety and efficacy of adding 8 m.g. dexamethasone and 50µg dexmedetomidine to 0.25% bupivacaine in onset of block, duration of sensory block and motor block, requirement of opioid analgesics and back up analgesic in postoperative period and incidence of postoperative vomiting. **MATERIALS AND METHODS:** 90 patients belonging to ASA 1, ASA 2, and ASA 3 status of age group between 20-80 years scheduled for elective upper limb surgeries were selected for this prospective randomized double blinded comparative study. They were randomly divided into three groups Group C (control group) where patients received 40 ml of 0.25%bupivacaine with 2 ml. of normal saline, Group D (dexamethasone group) where patients received 40 ml of 0.25%bupivacaine with 8 mg. of dexamethasone and Group DEX (dexmedetomidine group) where patients received 40 ml of 0.25%bupivacaine with 50µg of dexmedetomidine by sealed envelope technique for inter scalene block in patients scheduled for upper limb surgeries. Inj, Midazolam 1 mg given IV before block to reduce the anxiety, 2 mg. Butorphanol tartrate given IV before starting of surgery as an Intraoperative analgesic. **RESULTS:** There were no significant difference in onset of block between three groups, duration of motor block and sensory block is prolonged in group D and group DEX compared to group C, duration of motor block and sensory block is significantly prolonged in group D than group DEX. Postoperative opioid analgesic requirement is significantly lower in group D and group DEX compared to group C, there were no major differences in opioid and back up analgesic requirements in group D and group DEX. Incidence of postoperative vomiting is significantly lower in group D and group DEX compared to group C, There were no major differences in postoperative vomiting in group D and group DEX. There were no significant difference in requirement of backup analgesic in three groups. **CONCLUSIONS:** Addition of Dexamethasone and dexmedetomidine as an adjuvant to Bupivacaine for inter scalene brachial plexus block significantly prolongs the duration of sensory and motor block in patients undergoing upper limb surgeries. Duration of motor block & sensory block is significantly prolonged in dexamethasone group compared to dexmedetomidine group. Addition of Dexamethasone and dexmedetomidine to local anesthetics is remarkable safe and cost effective method of providing postoperative analgesia compared to continuous brachial plexus block using brachial plexus catheter. Requirements of opioid analgesic and back up analgesic,

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postoperative vomiting were significantly lower in both Dexamethasone and dexmedetomidine groups, compared to group C.

KEYWORDS: Bupivacaine, Dexamethasone, Dexmedetomidine, Interscalene brachial plexus block, Postoperative Analgesia, Postoperative Vomiting.

INTRODUCTION: Brachial plexus block provides us alternative anesthesia technique to general anesthesia for upper limb surgeries.^{1,2} Brachial plexus block is safer anesthesia technique compared to general anesthesia in patients with high risk factors for surgery like C.O.P.D, ischemic heart disease, cardiomyopathy, hypothyroidism. Of various local anesthetics, Lignocaine, Bupivacaine and Ropivacaine were commonly used. Lignocaine use is restricted for its limited duration of action. Ropivacaine for its higher cost and non-availability in our institution.

Brachial plexus nerve blocks have analgesic and opioid sparing benefits for upper limb surgery. Single shot peripheral nerve blocks as an alternative to general anesthesia have become a standard anesthesia technique throughout the world. Single shot peripheral nerve block technique is limited by the pharmacological duration and therapeutic index of local anesthetics. Continuous brachial plexus block can provide prolonged postoperative analgesia and opioid sparing effect; its use is limited by its cost and management challenges.

Therefore adjuvant analgesic strategy is an alternative to prolong the analgesic duration, to decrease the potential risk of side effects of local anesthetics by reducing the dose of local anesthetics. Many adjuvants have been added in the effort to prolong the duration of local anesthetics like epinephrine, Butorphanol tartrate, dexamethasone, tramadol, Buprenorphine, verapamil, methylprednisolone, Clonidine, dexmedetomidine.³

Of all the adjuvants dexamethasone, dexmedetomidine has shown promising results and is completely devoid of complications. Bupivacaine is a racemic mixture of stereoisomers. Belonging to amide class local anesthetics. Why dexamethasone would prolong regional nerve block is a subject of much discussion and speculation they may act by inhibition of phospholipase A2 as well as changes in cell function induced by glucocorticoid receptor activation. Steroids induce some degree of vasoconstriction, so one hypothesis is that it acts in a similar manner to epinephrine by reducing local anesthetic absorption.

More attractive hypothesis holds that dexamethasone may act locally on nociceptive C-fibers (via glucocorticoid receptors) to increase the activity of inhibitory potassium channels, thus decreasing their activity. The above mechanisms are dose depended on the amount of dexamethasone added to the local anesthetics. Dexmedetomidine is a clinically used anesthetic and belongs to high selective α_2 -adrenergic receptor agonists. Dexmedetomidine action have been shown to dose dependent and peripherally mediated.

A reduction of action potentials with dexmedetomidine which was not reversed with α_2 -adrenergic receptor antagonists is Noted.⁴ However all studies carried out so far to prove the peripheral action of α_2 agonists were animal studies. There are very few human studies, i.e. greater palatine and axillary brachial plexus nerve blocks have subsequently demonstrated that increased duration of sensory blockade can be achieved by adding dexmedetomidine to bupivacaine and levobupivacaine, respectively, by increasing the duration of analgesia with a single shot block we can achieve a longer duration of post-operative analgesia without significant clinical side-effects and hence we can avoid continuous catheterization.

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The present study is being undertaken to evaluate the onset time, duration of sensory and motor block, postoperative analgesic duration, incidence of vomiting, requirements of rescue and backup analgesic in the first 24 hours with 0.25% Bupivacaine with 50µg of dexmedetomidine combination compared to 0.25% Bupivacaine with 8mg. Of dexamethasone for brachial plexus block by interscalene approach.

MATERIAL AND METHODS: After obtaining intuitional ethics committee approval this study was conducted in the Department of Anesthesiology Govt. Medical College Anantapuramu. Informed consent was taken from the patients. The study was conducted over a period of 6 months. A prospective, randomized blinded study was undertaken in 90 patients scheduled for upper limb surgeries under inter scalene block between the age groups of 20 to 80 years, patients would be divided to 3 groups, each group containing 30 patients.

- Group C-received 40 ml of 0.25% Bupivacaine with 2 ml. of normal saline.
- Group D-received 40 ml of 0.25% Bupivacaine plus 8mg of dexamethasone and Group Dex-received 40 ml of 0.25% Bupivacaine plus 50µg of dexmedetomidine.

INCLUSION CRITERIA: ASA class 1, 2 & 3, age group between 20 to 80 years, consenting patients.

EXCLUSION CRITERIA: ASA class 4 & ASA 5, infection at the site of injection, presence of coagulopathies, hypersensitivity to Bupivacaine, dexamethasone. Dexmedetomidine, unwilling patients. On the day before surgery patients were explained about the procedure to be undertaken and the benefits and risks involved in the procedure. All the patients were explained about the visual analogue scale (VAS) and made well conversant with it. All the patients were instructed to remain in fasting state from 9 p.m. and Tab. Lorazepam 2 mg. given orally as an anxiolytic.

Patients were allotted to C, D and DEX groups by sealed envelope technique, after patients arrives in the operation theatre and after been ascertained the group patients were administered dose of normal saline, dexamethasone and dexmedetomidine according to the group category mixed with Bupivacaine.

Patient is secured with 18G Cannula on the opposite hand to be operated and maintenance fluid Dextrose normal saline is started. Patient is monitored with multichannel monitor for N.I.B.P, pulse rate, spo2, temperature and 3 lead E. C. G. inj. midazolam 1 mg. given intravenously before block to reduce the anxiety and discomfort during the block. All the resuscitation equipment and the equipment ready for general anesthesia are kept ready in case of inter scalene nerve block complication and block failure.

Inter scalene block is achieved by keeping the patient in supine position and head turned towards the opposite side.^{1,2} Inter scalenous groove is identified which lies immediately behind the lateral border of the clavicular head of Sternocleidomastoid muscle at the level of cricoid cartilage. Prominent tubercle present on the C₆ transverse process chassaignac's tubercle is identified. Inter scalenous groove is palpated by rolling the fingers posteriorly off the lateral border of the Sternocleidomastoid muscle; mark the groove as high as possible.

22g, 2.5 cm. needle is introduced and directed medially, caudally, and slight posteriorly in the direction of the transverse process C₆. Paresthesia is elicited and 40 ML. of 0.25% Bupivacaine mixed with 2 ml. of normal saline is injected in Group C, 40 ml. of 0.25% Bupivacaine mixed with 8 mg. of

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dexamethasone is injected in Group D and 40 ml. of 0.25% Bupivacaine mixed with 50µg of dexmedetomidine injected in Group DEX. Strict vigilance is kept for the complications of inter scalene block like intravascular injury, injection of local anesthetic into vertebral artery (loss of consciousness, seizures). Temporary partial phrenic nerve block, CNS toxicity (tinnitus, disorientation, perioral numbness) cardiovascular collapse, recurrent laryngeal nerve blockade (hoarseness of voice), Horner's syndrome (ptosis, miosis, anhydrosis) vagal nerve blockade, epidural/subarachnoid (total spinal), hematoma.⁵

Onset time of block (time for surgical anesthesia) was defined as the time gap between the completion of local anesthetic injection to pinprick discrimination. Postoperatively all the patients were shifted to the recovery room I.C.U. For first 24 hours. Patients were assessed for pain nausea and vomiting just after shifting to the recovery room I.C.U.

Postoperative pain assessed with visual analogue scale (VAS) score of 0-10(0=no pain, 10=worst imaginable pain).VAS scores >4 were treated with. Inj. Diclofenac sodium 75 mg. intra muscularly, if analgesia is still inadequate after 30 minutes inj. pentazocine 30 mg. intravenous given. The total administered doses of Diclofenac sodium and of pentazocine during the first 24 hours was recorded. Time for the first analgesic requirement was noted.

Duration of postoperative analgesia was defined as the time between last suture application and requirement for first rescue analgesic at VAS score above 4. Patients were monitored throughout the study period for evidence of feeling of pain during surgery and acceptance of the procedure. Sensory block was assessed by the pin prick method.

Assessment of sensory block was done at each minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade. Sensory onset was considered when there was a dull sensation to pin prick along the distribution of any of the above-mentioned nerves. Complete sensory block was considered when there was complete loss of sensation to pin prick.

Sensory block was graded as:

- Grade 0: Sharp pin felt.
- Grade 1: Analgesia, dull sensation felt.
- Grade 2: Anesthesia, no sensation felt.

Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade was considered when there was Grade 1 motor blockade. Peak motor block was considered when there was Grade 2 motor blockade. Motor block was determined according to a modified Bromage scale for upper extremities on a 3-point scale:

- Grade 0: Normal motor function with full flexion and extension of elbow, wrist and fingers.
- Grade 1: Decreased motor strength with ability to move the fingers only.
- Grade 2: Complete motor block with inability to move the fingers.

The block was considered incomplete when any of the segments supplied by median, radial, ulnar and musculocutaneous nerve did not have analgesia even after 30 min of drug injection. It was considered a failed block. Monitored for hemodynamic variables such as heart rate, blood pressure and oxygen saturation every 30 min after the block intraoperatively and every 60 min post-

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operatively. Assessment of blood loss was done and fluid was administered as per the loss. Duration of surgery was noted.

The intra- and post-operative assessment was done by an anesthesiologist who was unaware of the drug used. Patients were assessed for duration of analgesia as per a numeric rating scale of 0 to 10. The numeric rating scale was recorded post-operatively every 60 min till the score of 4. The rescue analgesia was given in the form of inj. diclofenac sodium (1.5 mg/kg) intramuscularly at the VAS ≥ 4 and the time of administration was noted.

All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma, local anesthetic toxicity and post-block neuropathy in the intra- and post-operative periods.

Comparison between three groups was done by using student's t-test. p value <0.05 was considered statistically significant, value <0.01 was considered highly significant, value >0.05 was considered insignificant.

RESULTS: There were no significant differences with respect to age, gender and duration of surgical procedure in three groups (table no=1). The anesthesia technique is similar in three groups.

Parameters	Group C	Group D	Group DEX
Age (YEARS)	43.2 $\pm$ 17.07	40.76 $\pm$ 16.44	45.76 $\pm$ 17.51
Gender (M:F)	19:11	17:13	18:12
DURATION OF SURGERY(MINUTES)	53.7 $\pm$ 23.42	60.26 $\pm$ 22.55	57.4 $\pm$ 21.34

TABLE 1: DEMOGRAPHIC PROFILE

The onset of action of interscalene block had no significant difference between three groups.

Parameters	Group C	Group D	P VALUE
TIME (MINUTES)	6.46 $\pm$ 2.41	6.6 $\pm$ 3.40	0.79

PARAMETERS	GROUP C	GROUP DEX	P VALUE
TIME(MINUTES)	6.46 $\pm$ 2.41	6.5 $\pm$ 2.64	0.95

PARAMETERS	GROUP D	GROUP DEX	P VALUE
TIME(MINUTES)	6.6 $\pm$ 3.40	6.5 $\pm$ 2.64	0.83

TABLE 2: TIME FOR ONSET OF ACTION OF INTERSCALENE BLOCK

Duration of motor block is significantly higher in group D and group DEX compared to Group C⁶. There was significant prolongation in duration of motor block in group D than group DEX.

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PARAMETER	GROUP C	GROUP D	P VALVE
TIME(MINUTES)	128.66±34.93	344.8±125.81	0.0000001

PARAMETER	GROUP C	GROUP DEX	P VALVE
TIME(MINUTES)	128.66±34.93	279±72.04	0.0000001

PARAMETER	GROUP D	GROUP DEX	P VALVE
TIME(MINUTES)	344.8±125.81	279±72.04	0.015

TABLE 3: DURATION OF MOTOR BLOCK

Duration of sensory block is significantly higher in group D and group DEX compared to group C⁷, whereas sensory block is more prolonged in group D Compared to DEX.

PARAMETER	GROUP C	GROUP D	P VALVE
TIME (MINUTES)	201.0±49.38	637.66±237.77	0.0000001

PARAMETER	GROUP C	GROUP DEX	P VALVE
TIME (MINUTES)	201.0±49.38	451.56±129.30	0.0000001

PARAMETER	GROUP D	GROUP DEX	P VALVE
TIME (MINUTES)	637.66±237.77	451.56±129.30	0.000384

TABLE 4: DURATION OF SENSORY BLOCK

Time for onset of pain in the postoperative period is significantly prolonged in group D and group DEX compared to group C⁸. Whereas onset of postoperative pain is more prolonged in group D than group DEX.

PARAMETER	GROUP C	GROUP D	P VALVE
TIME(MINUTES)	201.0±49.38	637.66±237.77	0.0000001

PARAMETER	GROUP C	GROUP DEX	P VALVE
TIME(MINUTES)	201.0±49.38	451.56±129.30	0.0000001

PARAMETER	GROUP D	GROUP DEX	P VALVE
TIME(MINUTES)	637.66±237.77	451.56±129.30	0.000384

TABLE 5: Time for onset of pain in the postoperative period

Diclofenac potassium administration in the first 24 hours of postoperative period has no significant differences between three groups.

PARAMETER	GROUP C	GROUP D	GROUP DEX
Dosage	75±0.0	75±0.0	75±0.0

TABLE 6: Diclofenac potassium dose administration in the postoperative period

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Pentazocine administration in the first 24 hours of postoperative period is significantly lower in group D and group DEX compared to group C⁸. There were no significant difference between group D and group DEX.

PARAMETER	GROUP C	GROUP D	P VALVE
Dosage(MG)	30±0.0	2±7.61	0.0001

PARAMETER	GROUP C	GROUP DEX	P VALVE
Dosage(MG)	30±0.0	4±10.37	0.0001

PARAMETER	GROUP D	GROUP DEX	P VALVE
Dosage(MG)	2±7.61	4±10.37	0.16

TABLE 7: Opioid dose administration in the postoperative period

Incidence of postoperative nausea and vomiting is significantly lower in group D and group DEX compared to group C⁹. There were no significant difference between group D and group DEX.

PARAMETER	GROUP C	GROUP D	P VALVE
FREQUENCY	0.56±0.50	0.066±0.36	0.000048

PARAMETER	GROUP C	GROUP DEX	P VALVE
FREQUENCY	0.56±0.50	0.066±0.25	0.000099

PARAMETER	GROUP D	GROUP DEX	P VALVE
FREQUENCY	0.066±0.36	0.066±0.25	0.99

TABLE 8: INCIDENCE OF POSTOPERATIVE NAUSEA AND VOMITING IN THE POSTOPERATIVE PERIOD

DISCUSSION: Regional anesthesia by using brachial plexus block has been used as ideal alternative to general anesthesia in patients with high risk factors for surgery under general anesthesia. Single shot brachial plexus block usage is limited by early onset of postoperative pain, high opioid dosage administration, higher incidence of postoperative vomiting, which can be managed by adding adjuvant to local anesthetics. Advantages of adding adjuvant to local anesthetic include prolongation of sensory block, motor block, delayed onset of pain in the postoperative period, low dosage administration of opioid analgesics in the postoperative period and lower incidence of postoperative vomiting.^{10,11,12}

In our study the surgeries varied from surgical neck of Humerus to lower end fractures of radius, ulna and fingers. No major complications were encountered in our study. To conclude in view of profound postoperative analgesia, delayed onset of pain in postoperative period, low dosage requirement of opioid, lower incidence of postoperative vomiting, lower rate of complications of interscalene block along with early ambulation and discharge makes inter scalene block with local

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anesthetic with adjuvant an ideal alternative anesthesia technique to general anesthesia in selected group of patients with high risk factors for general anaesthesia.^{13,14}

CONCLUSION: Addition of Dexamethasone and dexmedetomidine as an adjuvant to Bupivacaine for - interscalene brachial plexus block significantly prolongs the duration of sensory and motor block, decrease dose requirement of spopoperative opioid, decrease the incidence of postoperative nausea and vomiting in patients undergoing upper limb surgeries.¹⁶ Duration of motor block & sensory block is significantly prolonged in dexamethasone group compared to dexmedetomidine group without significant difference in postoperative Diclofenac and opioid requirement and incidence of postoperative nausea and vomiting.

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