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"EFFICACY OF DEXMEDETOMIDINE AS AN ADJUVANT TO 0.5% ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR POST OPERATIVE ANALGESIA"

Anesthesiology

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ABSTRACT

Introduction : Brachial plexus block can be done with single drug. Numerous routes to perform brachial plexus block - Supraclavicular, interscalene, infraclavicular , axillary. The supraclavicular route was used in this study which is easy to perform, need small volume of local anaesthetic.

Aims & Objectives: To compare effects of adjuvant dexmedetomidine to 0.5% ropivacaine on onset, duration of sensory and motor blockade, duration of postoperative analgesia & complications.

Material & methods : 60 patients undergoing orthopaedic surgeries of forearm were randomly assigned to Group - R (30 ml 0.5 % Ropivacaine + 0.5 ml normal saline) and RD (30 ml 0.5 % Ropivacaine + Dexmedetomidine 1 microgram/kg) (total volume 30.5 ml). Results : Demographic data were comparable.

Conclusion : Addition of Dexmedetomidine to Ropivacaine provides supraclavicular brachial plexus block with early onset & prolonged duration of sensory and motor blockade, prolonged duration of postoperative analgesia.

KEYWORDS

Supraclavicular, Ropivacaine, Dexmedetomidine.

INTRODUCTION

In upper limb surgeries regional anaesthesia is a better option for elective & emergency procedures on the hand, forearm and elbow. The supraclavicular technique was used by **Kulenkampffin[1].** Brachial plexus block can be done with single drug avoiding multidrug therapy as used in general anaesthesia .This technique avoids complications of general anaesthesia like interference with general body physiology, stress response to intubation, loss of protective reflexes and operation theatre pollution.

Numerous routes to perform brachial plexus block - Supraclavicular, interscalene, infraclavicular and axillary. The supraclavicular route was used in this study which is easy to perform, small volume of local anaesthetic is required as three trunks are compactly arranged resulting in rapid onset of reliable blockade. Concept of preemptive analgesia supports addition of adjuvants to local anaesthetics for prolongation of postoperative analgesia. Morphine was used as adjuvant with cocaine for first time by **Braun[2]**. Other adjuvants - NMDA antagonists (Ketamine, Magnesium), GABA agonists (Midazolam) and adrenergic agonists (Clonidine, Adrenaline) , COX-inhibitors (Ketorolac).

In British journal of anaesthesiology, **Marhofer[3]** published volunteer study of Dexmedetomidine as adjuvant to Ropivacaine which prolonged effect of peripheral nerve block. Local anaesthetic used in brachial plexus block - Lignocaine, Bupivacaine, Levobupivacaine and Ropivacaine. Ropivacaine has less cardiovascular and central nervous system toxicity as compared to Bupivacaine & used commonly.

In this study, we used Dexmedetomidine as adjuvant to Ropivacaine .

AIMS & OBJECTIVES: To compare effects of adjuvant dexmede tomidine to 0.5% ropivacaine on onset, duration of sensory and motor blockade, duration of postoperative analgesia & complications.

MATERIAL & METHODS :

Study Design: Prospective, randomized, comparative study.
Sample Size : Two groups with 30 subjects in each group.

GROUP R (n=30): 30 ml of 0.5% of Ropivacaine + 0.5ml normal saline (total volume 30.5 ml).

GROUP RD (n=30): 30 ml of 0.5 % of Ropivacaine + Dexmedetomidine 1microgram/ kg (total volume 30.5 ml).

After approval from hospital ethical committee, informed consent was taken from patients.

INCLUSION CRITERIA : Patients undergoing elective and emergency forearm surgeries, ASA grade 1 and 2, age ≥ 18yrs, Weight - 50- 70 kg.

EXCLUSION CRITERIA : Patient refusal, history of hypersensitivity to Ropivacaine or Dexmedetomidine, coagulopathy , local infection, fever, chest injuries.

Detailed clinical examination and investigations were done preoperatively. The procedure & use of the visual analogue scale was explained to patients preoperatively. All equipment and drugs necessary for resuscitation and general anesthesia were kept ready. Cardiac monitor, noninvasive blood pressure, & pulse oximeter were used for monitoring. Baseline pulse rate, systolic and diastolic blood pressure, mean arterial pressure (MAP), respiratory rate, SpO2 were noted. Intravenous line was secured with 18 G angiocath in large peripheral vein. Patient was given instruction before performing block to raise finger as signal if any change in sensation on arm to be operated. Patient was placed in a supine position with head turned away from side to be blocked & arm to be anaesthetized was adducted, extended along side toward ipsilateral knee. This will depress clavicle & allow better access to anterolateral neck structures. Skin is disinfected & transducer is positioned in transverse plane immediately superior to clavicle at its midpoint. Transducer is tilted caudally to obtain cross-sectional view of subclavian artery. Brachial plexus is seen as collection of hypoechoic oval structures lateral and superficial to artery. To decrease discomfort during needle insertion1 - 2 mL of local anaesthetic is injected 1 cm lateral to transducer using 25- to 27-gauge needle. Block needle is inserted in-plane toward brachial plexus, in a lateral-to-medial direction. With nerve stimulation (0.5 mA, 0.1 msec), entrance of needle into brachial plexus sheath is associated with palpable "pop" as needle passes through paravertebral fascia/ brachial plexus sheath. After aspiration, 1 - 2 mL of local anesthetic is injected to document proper needle placement. Group R received 30 ml of 0.5% solution of Ropivacaine +0.5ml normal saline (total volume 30.5 ml) & group RD received 30 ml of 0.5% solution of Ropivacaine with 1µg/kg of Dexmedetomidine (total volume 30.5 ml). Intraoperative sedation maintained with intravenous Midazolam 1 mg + Fentanyl 0.5 mcg/kg given prior to starting the procedure. Monitoring done for complications like nausea, vomiting, respiratory depression , bradycardia. Pulse, respiration, SpO2, blood pressure were recorded at 5, 10, 30, 60, 120, 180, 240, 360, and 480 min after completion of the injection. Postoperatively inj. Diclofenac sodium 75 mg intramuscularly was used as rescue analgesic. Onset of sensory block was assessed as time elapsed between injection of drug and complete loss of cold perception of hand. Skin was tested with spirit soaked swab. Assessment of motor blockade was done using Bromage three point score (0 = Normal motor function with full flexion and extension of elbow, wrist and fingers, 1 = decreased motor strength with ability to move fingers & or wrist only, 2 = complete motor blockade with

inability to move fingers). Recovery from sensory block was noted as time when patients started responding to blunt end of needle. Recovery from motor block was noted when patient had motor movement (Bromage score ≥1). Continuous monitoring for complications as nausea, vomiting, bradycardia, hypotension, respiratory depression, bronchospasm, pruritus was done . Vital parameters as pulse rate, blood pressure, respiratory rate, O2 saturation were recorded at 5,10,15,30,45,60,90,120 minutes 4, 6,12,18, 24 hours after giving block. Duration of analgesia was taken from time of onset of block to first complaint of pain. For VAS score >4 rescue analgesic Inj. Ketamine 1 mg / kg IV intraoperatively & postoperatively Inj. Diclofenac sodium 75 mg intramuscularly was used. Pain will be assessed using standard 100 mm Visual Analogue Scale (VAS). Data analysis was done with software 'GraphpadPrism5'. Comparison of quantitative data done by unpaired 't' test & non-parametric (qualitative) by Chi-square test, Chi-square test for trend and Fisher Exact test depending on types of data. P<0.05: Statistically significant. P>0.05: Statistically non significant.

RESULTS

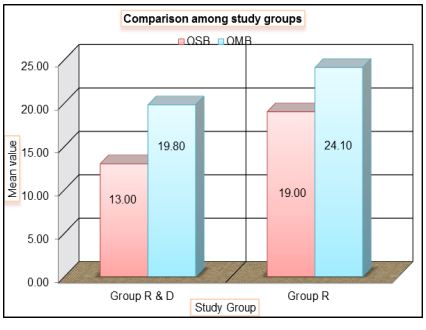
Both groups were comparable as far as age, sex, weight, ASA status, duration & type of surgery. Onset of sensory block (13.00+/-2.32 min) in Group RD & (19.00+/-2.83 min) in Group R,(p <0.001). Onset of motor block (19.80+/-1.90 min) in group RD (24.10 +/- 2.40 min) in group R , (p <0.001). Mean total duration of sensory blockade in group RD (728.83+/-10.23 minutes) & group R (566.67 +/- 24.89 minutes), (p < 0.001). The duration of motor blockade in group RD (608.83+/-10.23 minutes) & group R (462.83+/-15.01 minutes),(p <0.05). Mean duration of post-operative analgesia in group RD 12-14 hrs (728.83 mins) & 9.44hrs (566.67mins) in group R, (p<0.05). Analgesic consumption within 24 hours was less in Group RD, which was statistically significant (p<0.05). MAP & pulse rate was lower in group RD, (P<0.05). Fall in MAP started after 15 minutes and returned to baseline after 4 hours. In group RD pulse rate was maximally reduced after 30minutes and normalised to base line after 18 hours. In no case reduced pulse rate & MAP required treatment. Good haemodynamic stability was there in group RD as compared to group R. No intra or postoperative complication in both groups.

TABLES & GRAPHS

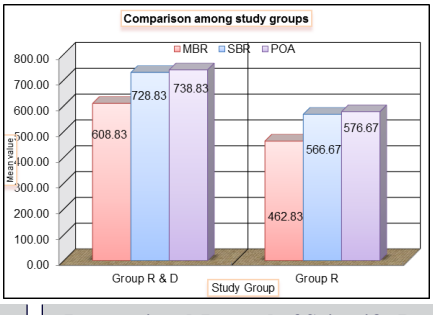
TABLE 1:

Parameter	Group RD Mean S.D.	Group R Mean S. D.	P Value
Onset of sensory block (OSB)	13.00±2.32	19.00±2.83	<0.05
Onset of motor block (OMB)	19.80±1.90	24.10±2.40	<0.05
Motor block recovery (MBR)	608.83±10.23	462.83±15.01	<0.05
Sensory block recovery (SBR)	728.83±10.23	566.67±24.89	<0.05
Postop analgesia (POA)	738.83±10.23	576.67±24.89	<0.05

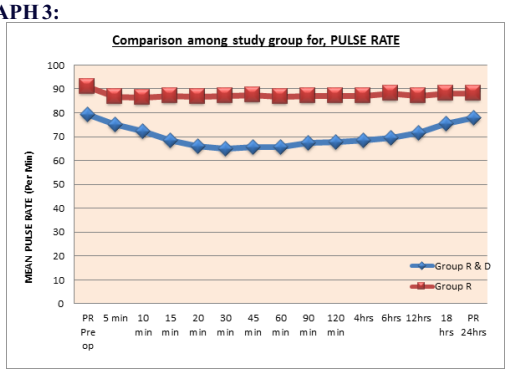
GRAPH 1:



GRAPH 2:



GRAPH 3:



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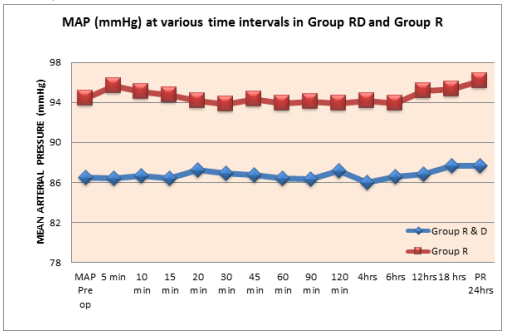

DISCUSSION

Supraclavicular approach produces rapid onset & reliable blockade of brachial plexus. But limitation is inability to provide postoperative analgesia even if long-acting Ropivacaine is used alone. Dexmedetomidine acts on α2 adrenergic receptors found in peripheral nerves. Brachial plexus block was introduced by **Prof. Halsted in 1884** to carry out surgical procedures in upper extremity with selective anaesthesia of operative field without interfering with patient's normal physiology.

We used 0.5 % of inj. Ropivacaine 30 ml which amounts to 150 mg which is lower than the prescribed limit for dosage of Ropivacaine in peripheral nerve block[5]. Adverse effects seen with ropivacaine were hypotension, nausea, vomiting, bradycardia, and headache[5]. Dexmedetomidine is a selective α2 adrenoreceptor agonist with evidence of an increased ratio of alpha 2 to alpha 1 activity of 1620:1 as compared to 220:1 when contrasted against clonidine. **Esmaoglu[6]** carried out prospective ,double blinded study and concluded that dexmedetomidine added to Levobupivacaine prolonged axillary brachial plexus block.

Marhofer[3] published first human volunteer study to investigate the effects of Dexmedetomidine as adjuvant to Ropivacaine on peripheral nerve block. We used Dexmedetomidine in dose of 1 microgram/kg **(Rancourt[7]).**

Esmaoglu[6] observed statistically significant (p value < 0.05) longer duration of post operative analgesia in Dexmedetomidine group as compared with plain Levobupivacaine.

Thus addition of Dexmedetomidine(1ug/kg) to Ropivacaine in supraclavicular brachial plexus block provide good intraoperative anaesthesia with prolonged postoperative analgesia reducing consumption of analgesic in first 24 hrs ,with added advantage of conscious sedation, haemodynamic stability and minimal side effects. General anesthesia was not required for any patient. So, the success rate of our study was 100%.

CONCLUSION

Dexmedetomidine as adjuvant to Ropivacaine in brachial plexus block results in early onset of sensory and motor blockade, prolonged duration of postoperative analgesia with decreased need of analgesics in first 24 hour postoperatively. Added advantage of conscious sedation, haemodynamic stability and minimal side effects makes Dexmedetomidine, potential adjuvant to peripheral nerve blocks. This helps in reducing cost of treatment, hospital stay and makes patient more comfortable which allows early ambulation in immediate postoperative period. It can be useful in day care surgery.

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