ORIGINAL ARTICLE

Effect of Addition of Dexmedetomidine in Ropivacaine and Bupivacaine in Sensory and Motor Blockade and Post Operative Analgesia in Axillary Brachial Plexus Block for Hand and Forearm Surgery

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ABSTRACT

Introduction: Axillary approach of brachial plexus block provides excellent operating conditions for forearm and hand surgeries with less risk. The α2:α1 selectivity of Dexmedetomidine is eight times that of clonidine and its high specificity for α2 subtype makes it a much more effective as adjuvant. The present study is designed to evaluate the effect of Dexmedetomidine as an adjuvant to 0.5% Ropivacaine hydrochloride with 0.5% Bupivacaine hydrochloride insensory and motor blockade and post operative analgesia axillary brachial plexus block in hand and forearm surgery.

Methodology: After institutional ethical committee clearance and informed written consent, prospective randomized controlled study of 60 patients of either sex, aged 18-60 years with ASA grade I, II and III undergoing forearm or hand surgery at SMIMER hospital was done.In Group 1, Inj. 0.5% Bupivacaine hydrochloride 20ml, Inj. 0.5% Ropivacaine hydrochloride 20ml and Inj. Dexmedetomidine (2μg/kg) were given. In Group 2, Inj. 0.5% Bupivacaine hydrochloride 20ml and Inj. 0.5% Ropivacaine hydrochloride 20ml was given. In operation theatre, Sensory blockade was assessed by three modalities. Pain (Pin Prick), Temperature (Alcohol wipe) and Touch (11 Point Scale). Motor Blockage by Lovett rating score, Sedation were assessed by Ramsay Score and Visual Analog Scale for Pain Relief were used.

Results: Demographic data like age, sex, weight of patients and surgical characteristics like duration & type of surgery were comparable in both the groups ($P>0.05$).The duration of motor blockade was significantly prolonged in Group 1 ($p<0.01$).VAS was comparable in immediate postoperative period upto 10 hrs but after that it became significantly higher in control group across the time. Mean total analgesic requirement (inj. Diclofenac sodium) was significantly less in 48 hours after performing axillary block in Group 1 (250 ± 35.95 mg) as compared to group 2 (405 ± 42.24 mg) ($p<0.01$).

Conclusion: Addition of dexmedetomidine to local anaesthetic agent in peripheral nerve block leads to decreased total consumption of analgesic postoperatively. Furthermore, in axillary brachial plexus block dexmedetomidine significantly prolonged both sensory as well as motor blockade and post operative pain relief.

Keywords: Axillary Brachial plexus block, Dexmedatomidine, Ropivacaine, Bupivacaine, Visual Analogue Scale

INTRODUCTION

Axillary approach of brachial plexus block provides excellent operating conditions for forearm and hand surgeries with less risk of major complications like pneumothorax or diaphragmatic paresis. This makes it suitable for emergency department and outpatient use. It is a safe technique with low cost and advantage of prolong postoperative analgesia.

Axillary brachial plexus block was given by perivascular technique and drugs were injected according to the group assigned after negative aspiration for blood. To avoid the tourniquet pain, intercostobrachial nerve was blocked on the upper middle aspect of arm.

Many drugs have been used as adjuvants to local anesthetic agents to prolong the duration of peripheral nerve blocks. Clonidine, a partial α-2 adrenoceptor

agonist has been reported to prolong the duration of anesthesia and analgesia during such blocks.[1-3] The α2:α1 selectivity of Dexmedetomidine is eight times that of clonidine and its high specificity for α2 subtype makes it a much more effective sedative and analgesic agent.[4]

It has been reported to improve the quality of intrathecal and epidural anesthesia.[5-8] Its use in peripheral nerve blocks has recently been described.[9-11]

The present study is designed to evaluate the effect of Dexmedetomidine as an adjuvant to 0.5% Ropivacaine hydrochloride with 0.5% Bupivacaine hydrochloride insensory and motor blockade and post operative analgesia axillary brachial plexus block in hand and forearm surgery.

METHODOLOGY

The present study was a prospective randomized controlled study done among patients undergoing hand or forearm surgery in a tertiary care hospital of Surat, Gujarat. Patients undergoing Axillary Brachial plexus block for hand or forearm surgery of either sex, aged 18-60 years with ASA grade I, II and III were included in the study.

Exclusion criteria: Patients fulfilling any of the below criteria were excluded from the study.

- Local infection at site of injection.
- Patients on anticoagulant therapy.
- Patients with hypersensitivity to any study drugs.
- Patients with cardiovascular diseases like fixed cardiac output, valvular heart disease, conduction block.
- Patient with preexisting peripheral neuropathies, uncontrolled diabetes mellitus and pregnancy.
- Patchy or inadequate anaesthesia supplemented with general anaesthesia.
- Patient taking α-2 agonist and antagonist
- Not willing to give informed written consent.

Permission of institutional ethical committee of SMIMER, Surat, was obtained to conduct the study.

Thorough preanaesthetic evaluation of the patient was done by present history, past history of medical illness or operation, family history and history of drug allergy.General examination was carried out including general condition, temperature, pulse, blood pressure, respiratory rate, pallor, icterus, clubbing, lymphadenopathy, dehydration and oedema. Local examination of axilla for infective foci was done. Patient was assessed by MPG grading.Systemic examination of cardiovascular system, respiratory system, central nervous system and alimentary system was done.Along with routine investigations like complete blood count, urine examination, random blood sugar, renal function test, coagulation profile, chest X-ray and ECG, specific investigations if required were done.

On preoperative visit, physical status was decided according to ASA standards. Procedure, type of anaesthesia and visual analogue scale (VAS) for the postoperative pain assessment were explained to all patients and informed written consent was taken. On previous night, Tablet Alprazolam 0.5mg was given to allay anxiety and patients were kept nil by mouth for 6-8 hours.

On the day of surgery, in recovery room written informed consent and nil by mouth status of patients were confirmed. Intravenous line was secured with 20G intravenous cannula in contra lateral arm with inj.DNS 4-5ml/kg/hr. Inj. Glycopyrolate (3μg/kg) and Inj. Midazolam (0.03mg/kg) I.M. were given as premedication 45min before surgery. Pulse, BP, SpO_2, Respiratory rate, Sedation score were recorded after 45min of premedication and considered as basal value.

Patients were randomly allocated by chit method into 2 groups of 30 patients each:

In Group 1(Dexmedetomidine group), Inj. 0.5% Bupivacaine hydrochloride 20ml, Inj. 0.5% Ropivacaine hydrochloride 20ml and Inj.Dexmedetomidine (2μg/kg) were given.

In Group 2(Control group), Inj. 0.5% Bupivacaine hydrochloride 20ml and Inj. 0.5% Ropivacaine hydrochloride 20ml were given.

In operation theatre, Pulse, BP, SpO_2, Respiratory rate, Sedation score were recorded. Again reassurance was given to the patient and the procedure was explained.Axillary brachial plexus block was given under all aseptic and antiseptic precautions by perivascular technique and drugs were injected according to the group assigned after negative aspiration for blood. To avoid the tourniquet pain, intercostobrachial nerve was blocked on the upper middle aspect of arm.All standard protocols of axillary brachial plexus block were observed.[12]

Sensory and motor score as well as level of sedation were monitored every 5 min up to 30 min, every 15min up to completion of surgery and post operatively 1 hourly interval for 6 hours, 2 hourly up to 18 hrs and then at 24 hrs and 48hrs. Postoperatively, when VAS≥4, inj. Diclofenac sodium i.m. was administered as rescue analgesia, time was noted and total dose was calculated upto 48hrs.

Complications of the brachial plexus block like systemic toxicity, neuropathy and side effect of study drugs like hypotension, bradycardia, nausea, vomiting

and respiratory depression were noted perioperatively.

Sensory blockade was assessed by three modalities. Pain (Pin Prick), Temperature (Alcohol wipe) and Touch (11 Point Scale). Motor Blockage by Lovett rating score, Sedation were assessed by Ramsay Score and Visual Analog Scale for Pain Relief were used.

RESULTS

Demographic data like age, sex, weight of patients and surgical characteristics like duration & type of surgery were comparable in both the groups (P>0.05).Basal mean pulse rate, 86 ± 6.5 per minute in Group 1 and 86 ± 10.0 per minute in Group 2, were comparable in both the groups (p>0.05).

More sedation (asleep but easily arousable - score 3) was observed intraoperatively as well as postoperatively upto 3hrs in dexmedetomidine group as compared to control group (p<0.01).The time for mean onset of sensory block was 15.63 ± 2.74 minutes in Group 1 and 19.46 ± 2.16 minutes in Group 2 while for onset of motor block was 18.73 ± 2.98 minutes in Group 1 and 23.3 ± 2.36 minutes in Group 2. So onset time of sensory as well as motor block was faster in dexmedetomidine group as compared to control group (p<0.01) but first sensory and then motor block was observed in both the groups.

Table 1: Postoperative visual analogue scale

VAS at time	Group 1	Group 2
2 hr	0	0
4 hr	0	0
6 hr	0	0
8 Hr	0	0
10 hr	0	0.1
12 hr	0	1
14 hr	0	4.5
18 hr	0.4	5.4
24 hr	5.2	6.6
48 hr	7.1	7

Table 2: Total analgesic requirement upto 48 hrs

Total Analgesia Required	Group 1 (%)	Group 2 (%)
75 mg	0	0
150 mg	0	0
225 mg	20 (66.70)	0
300 mg	10 (33.33)	1 (3.33)
375 mg	0	16 (53.33)
450 mg	0	13 (43.33)

The duration of motor blockade was significantly prolonged in Group 1 (22.33 ± 1.39 hrs) as compared to Group 2 (14.5±1.27 hrs) (p<0.01).Postoperative analgesia was assessed by visual analogue scale (VAS). VAS was comparable in immediate postoperative period upto 10 hrs but after that it became significantly higher in control group across the time. So dexmedetomidine (2μg/kg) as an adjuvant to Inj. (0.5%) Bupivacaine hydrochloride 20ml + Inj. (0.5%) Ropivacaine hydrochloride 20ml in axillary brachial plexus block significantly prolonged both sensory as well as motor blockade.

Mean total analgesic requirement (inj. Diclofenac sodium) was significantly less in 48 hours after performing axillary block in Group 1 (250 ± 35.95 mg) as compared to group 2 (405 ± 42.24 mg) (p<0.01).

DISCUSSION

Surgical pain is a universal phenomenon affecting all patients in the perioperative period. Apart from an agonizing sensory experience associated with it, acute pain has several deleterious effects on the physique and the psyche of the sufferer. An anticipation of these effects combine with a humanitarian urge to relieve pain, play a pivotal role in provision and optimization of postoperative analgesia.[13]Analgesia during perioperative period is one of the mainstay of balanced anaesthesia, as uneventful postoperative periods make surgery comfortable.

Regional anaesthesia is a safe and effective alternative technique for upper or lower limb surgery. Various approaches of brachial plexus block are used from which axillary brachial plexus block is a commonly used anaesthetic technique for forearm and hand surgeries. Opioid, steroid, midazolam, magnesium sulphate, α-2 agonist- clonidine and dexmedetomidine can be used as an adjuvant to local anaesthetic agent to improve the quality and duration of peripheral nerve block as well as postoperative analgesia.

Recently α-2 adrenoreceptor agonists are being used for their sympatholytic, sedative, analgesic and anaesthetic properties. In present study, more selective α-2 agonist dexmedetomidine has been added to local anaesthetic agents for axillary brachial plexus block as dexmedetomidine is eight times more specific for α-2 adrenoreceptor with α-2: α-1 selectivity ratio of 1620:1, compared with 200:1 for clonidine, especially for the 2a subtype which makes dexmedetomidine more effective than clonidine for sedation and analgesia.[14]

Dexmedetomidine enhance central and peripheral neural blockade with local anaesthetic agents. α-2 adrenoceptors located at the peripheral nerve endings produces analgesia by preventing norepinephrine release.In the present study, axillary approach of brachial plexus block has been selected because of its

ease of administration, safety, reliability and accepted technique for forearm and hand surgery.

The results of the above studies were very well correlated with the present study. The total requirement of analgesic in first 48 hours was significantly less in dexmedetomidine group. So addition of dexmedetomidine to local anaesthetic agent in peripheral nerve block leads to decreased total consumption of analgesic postoperatively. This is of utmost importance in patients with a compromised renal and liver status.

CONCLUSION

Addition of dexmedetomidine to local anaesthetic agent in peripheral nerve block leads to decreased total consumption of analgesic postoperatively. Furthermore, in axillary brachial plexus block dexmedetomidine significantly prolonged both sensory as well as motor blockade and post operative pain relief.

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