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Dexmedetomidine as an Adjuvant in Supraclavicular Brachial Plexus Block: A Comparative Study

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Abstract

Aims and Objectives: To compare the combination new drug dexmedetomidine and bupivacaine with bupivacaine alone in terms of - Onset and duration of sensory, and motor blocks, Duration of analgesia, Hemodynamic parameters and adverse effects. A prospective randomised double blind study done on 60 patients posted for various upper limb surgeries. They divided in two groups each including 30 patients, in which Group B received Bupivacaine 0.25% (30 cc) + 1ml normal saline. Group D received Bupivacaine 0.25% (30 cc)+ Dexmedetomidine 1 mg/kg + normal saline to make a total 31 ml. supraclavicular block given using peripheral nerve stimulator. *We observed that,* Demographic data and surgical characteristics were comparable in both the groups. The onset times for sensory and motor blocks were significantly shorter in B than A group ($P < 0.001$). Duration of blocks was significantly longer ($P < 0.001$) in B group. The duration of analgesia was significantly longer in B group than A group ($P < 0.001$). Hemodynamic parameters like HR, SBP, DBP were lower in group B. We conclude that, Dexmedetomidine at the dose of 1 ug/kg body weight added as an adjuvant to 0.25% bupivacaine in supraclavicular brachial plexus block in upper limb surgeries is highly effective in prolongation of sensory analgesia and provides better post operative analgesia. So, the patient remain comfortable in the post operative period with considerable therapeutic benefit & without any potential side effects.

Keywords: Dexmedetomidine; Supraclavicular Brachial Plexus Block; Analgesia.

Introduction

Pain is an unpleasant, sensory and emotional experience associated with actual or potential tissue damage. Pain relief is one of the most important challenge of medical sciences and is the primary aim of an anaesthesiologist.

Peripheral nerve blockade is now a well accepted component of comprehensive anesthetic care. Its role has expanded from the operating suite into area of postoperative and chronic management of pain. Skillfull application of the peripheral nerve block widens the anaesthesiologists scope of options in providing ideal anesthetic care. Peripheral nerve block provides good aurgical anesthesia and post operative analgesia and thus helps in ambulatory surgery. A peripheral nerve block is safe in high risk patients with chronic illness, cardiopulmonary diseases, diabetes as it minimally disturbs the coronary hemodynamics and blunts the response of stress to surgery.

Regional blocks offer many advantages over general anaesthesia. It reduces complications and side effects of general anesthesia like post operative nausea vomiting, hypotension, and deep vein thrombosis. It avoids stress response of laryngoscopy. Supraclavicular brachial plexus block is the preferred block for upper limb surgeries. It achieves ideal surgical anesthesia and maintains stable intraoperative hemodynamics.

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In our study we have used classical supraclavicular block. Since, at the trunk level brachial plexus are present most compactly, block provides entire upper extremity anesthesia in most consistent and efficient manner. Hence it is the most reliable regional block used for upper limb surgeries.

Onset of action and duration of analgesia were the limiting factors of brachial plexus block. This can be overcome by increasing the volume of local anesthetics or by addition of adjuvant. Increasing the volume has increased risk of systemic toxicity so addition of ideal adjuvant is considered better. Various adjuvants has been used till now to prolong the duration of analgesia, like opioids, $\alpha 2$ agonists, ketamine, midazolam, dexamethasone etc.

Alpha-2 adrenergic agonists have been the focus of interest as they provide sedative, analgesic, perioperative sympatholysis. Dexmedetomidine is a highly selective alpha-2 adrenergic agonist. Dexmedetomidine is being used in various fields like intravenous regional anaesthesia, intravenous sedation and analgesia for intubated and mechanically ventilated patients in intensive care units, and non intubated patients for surgical and other procedures. It has been shown to improve the quality of intrathecal and epidural anaesthesia. Its use in peripheral nerve blocks has recently been described. However, the report of its use in supraclavicular block is limited.

Materials and Method

The study was conducted in Department of Anaesthesia, Tertiary Care Hospital. It included 60 patients undergoing elective surgery of the upper limb. Written informed consent was obtained from each participating patient in their own vernacular language prior to enrolment into the study after complete explanation of the study protocol and procedure.

It is a Prospective, Randomized, Double-Blind Interventional type of Hospital based Controlled study. The comparison of mean between the two groups with respect to demographic variables, pulse rate, non-invasive blood pressure, SpO_2, onset, degree, duration of sensory and motor blocks, and visual analogue score was, analysed by using unpaired t-test. P value<0.05 was considered significant.

Study includes all patients between the age group 18-60 years and asa1-3. we excluded patients who are not giving consent, pregnancy, obese, bleeding disorder.

The patients were randomly divided into two groups each of 30 patients by chit in box method. This was done and the medications were prepared by another person so that patient and the person doing the study did not know in which group a particular patient had been allotted.

Group B: Bupivacaine 0.25% (30 cc) +1ml normal saline.

Group D: Bupivacaine 0.25% (30 cc) + Dexmedetomidine 1 mg/kg + normal saline to make a total 31 ml.

Intravenous access was obtained in the limb opposite to that undergoing surgery with 20 G IV Cannula. Standard monitors like ECG monitoring, Pulse oximeter, Non invasive blood pressure were connected and monitored in all the patients. Patient in supine position with head turned on opposite side from the side to be blocked, arm to be blocked placed slightly abducted and flexed at elbow. Mid point of clavicle was identified and marked 1.5 -2 cm posterior to this Subclavian artery palpated and needle inserted posterior and lateral to the pulsation. needle inserted at this point backward, inward, and downward direction till the contraction of forearm seen, current decreased to 0.5 ma if contraction still present 30 ml of above said solution injected after negative aspiration. After this, massage was done at this area for 3 min to felicitate equal distribution of drug. Procedures involved in our study were of moderate duration (60-90 min) which includes fracture radius ulna, mid shaft fracture of humerus, supracondylar humerus fracture, implant removal etc.

Sensory block assessed by pin prick method (Holmen score)

score 1: normal sensation of pinprick

score 2: pin prick felt as sharp pointed but weaker compared with same area in the other upper limb

score 3: pin prick recognized as touch with blunt object

score 4: no perception of pin prick.

Sensory onset was considered when Holmen score > 1. Complete sensory block was considered when there Holmen score = 4

Motor block assessed by modified Bromage 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.

Onset of motor blockade was considered when there was Grade 1 motor blockade. Complete motor block was considered when there was Grade 2 motor blockade.

Quality of Block was assessed by the following numeric scale

Grade 4 (excellent): no complaints from the patient.

Grade 3 (good): minor complaints with no need for supplemental analgesia.

Grade 2 (moderate): complaint that required supplemental analgesia.

Grade 1(unsuccessful): patient given general anaesthesia.

Assessment of postoperative pain was done by VAS (Visual Analogue Scale). VAS Score 0-no pain to 10-worst pain. Inj. Diclofenac Sodium was given intra-muscularly in the dose of 1–5 mg/kg as rescue analgesic at VAS score of ≥ 5. During the procedure intraoperative vitals like pulse, BP, SPO_2 and ECG were monitored every 5 min for first 15 min, and then every 15 min till procedure was completed. Post operative vitals monitored every 30 min. The duration of analgesia was calculated from onset of block to the first complaint of pain. The incidence of side effects such as bradycardia, hypotension, sedation noted and managed accordingly.

Results

The age, sex, body weight, and duration of surgery in the two groups were found to be comparable. The quality of analgesia was excellent in 86% patients good in 14% patients in group D where as quality of analgesia was excellent in 33% and good in 77% in group B. This difference was also highly statistically significant (P<0.001)

Intra-operative and post-operative vital monitoring did not show any significant variations in both groups and vitals remained stable.

Table 1: Demographic Profile

	Group B(N=30) Bupivacaine	Group D(N=30) Dexmedetomidine	P Value
Age (yrs)	36.4±14.9	38.9±17.2	0.54 (N.S)
Weight(kg)	56.9±7.5	55.6±11.1	0.59 (N.S)
Gender	16:14	14:16	0.52 (N.S)

Note: N.S.- Not Significant; S- Significant.
Table.1 shows age, weight, and gender distribution in both groups.

Table 2: Onset time and duration of Sensory and Motor block

	Group B(N=30) Bupivacaine	Group D(N=30) Dexmedetomidine	P Value
Onset time of sensory block	15.1±1.8	2.7±0.9	0.0001(S)
Onset time of motor block	12.40±2.3	4.2±1	0.0001(S)
Duration of sensory block	209.3±19.6	456.7±65.8	0.0001(S)
Duration of motor block	185.0±23.0	390.3±51.5	0.0001(S)
Duration of analgesia	250.7±24.2	706.0±39.9	0.0001(S)

Note: N.S.- Not Significant; S- Significan
Table 2 shows the onset time duration of sensory and motor and analgesia in both groups

Table 3: Showing comparison with other studies

Study	Onset of sensory	Onset of motor	Duration of sensory	Duration of motor	Duration of analgesia
My study	2.70±0.9	4.20±1	456.7±65.8	390±51.5	706.0±39.9
Gandhi R	------	------	732±48.9	660±60.4	732±90.1
Sarita	1.77±1.28	4.65±2.46	413±87.31	472±90	456±9.7
Sandhya	------	------	755±12.6	702±82.2	776±110.9
Keshav	1.7±1.28	4.6±2.41	400±85.13	470±86.6	732±95.1

Discussion

Though there are different approaches to brachial plexus block, Supraclavicular approach is one of the most commonly employed regional nerve block technique for upper limb surgery.

This approach is attractive due to it's effectiveness in terms of cost and performance, margin of safety along with good postoperative analgesia. Supraclavicular block provides an even sensory and motor blockade of all nerves of the brachial plexus. An additional advantage is that the block can be performed with the patient's arm in any position.

The acceptance of regional nerve block technique has been limited by two major factors slow onset of action and short duration of action, to overcome this Various methods have been used which mainly includes increasing the volume of drug or addition of adjuvant. In our study we compared the effect of adding dexmedetomidine (1µg/kg) to 0.25% Bupivacaine with 0.25% Bupivacaine alone in supraclavicular block. Dexmedetomidine drug was studied previously by many authors and have shown that Dexmedetomidine has action on peripheral nerves and have beneficial use in peripheral nerve block. Most of the studies done on dexmedetomidine are supportive.

In our study, Mean onset of sensory block was earlier in Group D (2.7±0.9min) as compared to Group B (15.1±1.8min) and Mean onset of motor block was also earlier in Group D (4.2±1min) as compared to Group B(12.4±2.3min). mean duration of sensory block was longer in Group D (456.7±65.8min) as compared to Group B (209.3±19.6min) and Mean duration of motor block was also longer in Group D (390.3±51.5 min) as compared to Group B (185±23 min). mean duration of analgesia was longer in Group D (706.7±39.9 min) as compared to Group B (250.7±24.2 min).

In our study hemodynamic parameters like Pulse Rate, Systolic Blood Pressure, Diastolic Blood Pressure and Mean Arterial Blood Pressure were better in Dexmedetomidine group as compared to controle (Bupivacaine) group. Although the hemodynamic parameters were significantly low in Dexmedetomidine group no patient required any mediacation. No side effects/complications was seen in either of the groups during the first 24hr in post operative period.

Table 3 shows comparision of our parameters with other studies and shows our results are comparable with others results.

Conclusions

Dexmedetomidine at the dose of 1 µg/kg body weight added as an adjuvant to 0.25% bupivacaine in supraclavicular brachial plexus block in upper limb surgeries is highly effective in prolongation of sensory analgesia and provides better post operative analgesia. So, the patient remain comfortable in the post operative period with considerable therapeutic benefit & without any potential side effects.

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