BUPRENORPHINE AS AN ADJUVANT IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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Abstract

Background & Aims: Brachial plexus block is a useful alternative to general anaesthesia. Postoperative analgesia is an added advantage. Buprenorphine, an agonist antagonist opioid has been used by various routes to prolong analgesia. The present study was undertaken to assess the analgesic efficacy of Buprenorphine with Bupivacaine in brachial plexus block.

Methods: A prospective, randomized, double blind study was done on 60 adult patients of American Society of Anesthesiologists 1 and 2, aged between 18-50 years and scheduled for various upper limb surgeries. Patients were divided into two groups of 30 each. Group C (control group) received 38ml of inj. bupivacaine 0.25% +2ml normal saline and group B (Buprenorphine group) received 38ml of inj. bupivacaine 0.25% +2ml inj. Buprenorphine (preservative free) (0.3 mg). Patients were observed for onset and duration of motor block, onset and duration of sensory block, duration of pain relief and occurrence of any complications.

Results: Post operative analgesia was significantly longer (901.33±60.04 min) in group B, as compared to group C (343.00±33.02 min) with p value <0.001. Duration of sensory block in group C was 322.16±31.80 min and in group B 647.83±55.70 min. with p value <0.001. Pain score was significantly low in group B (mean 1.44), compared to group C (mean 5.60) at 12 hours postoperatively.

Conclusion: Addition of Buprenorphine 0.3 mg to 38ml of bupivacaine 0.25% for supraclavicular brachial plexus block prolonged sensory blockade and post-operative analgesia without increasing the risk of adverse effects.

Keywords: Bupivacaine; Buprenorphine; Supraclavicular brachial plexus block; Postoperative analgesia.

1. Introduction

Supraclavicular brachial plexus block via Winnies’ approach1 using a nerve locator is a very popular mode of anesthesia for various upper limb surgeries. This approach is attractive due to its effectiveness in terms of cost and performance, margin of safety, along with good postoperative analgesia. Supraclavicular approach gives the most effective block for all portions of upper extremity and is carried out at the level of trunks of brachial plexus2. The plexus is blocked where it is most compact 3 i.e. at the middle of brachial plexus, resulting in homogeneous spread of anesthetic throughout the plexus with a fast onset and complete block4. A variety of opioids have been studied for brachial plexus blockade including buprenorphine hydrochloride5. Buprenorphine is more potent than morphine sulphate with substantially longer duration of action and fewer side effects6,7. The present study was planned with the aim to evaluate and compare the effects of addition of buprenorphine in regard to the block characteristics, the quality of post-operative pain relief and the duration of analgesia, when given along with bupivacaine in supraclavicular brachial plexus block for upper limb orthopaedic surgeries.

2. Methodology

After approval by the hospital ethical committee, a prospective, double blind, randomized study was carried out at Acharya Vinoba Bhave Rural Hospital, JNMC, Sawangi, Wardha(India), during the period between August -2008 to September -2010 . 60 adult patients of both gender, ASA grade I and II, between ages 18 to 50 years, posted for various upper limb surgeries were selected for the purpose of this study. Patients with bleeding problems, sepsis, compromised cardiorespiratory profile, known neurological deficit, history of seizures, pneumothorax, pregnancy, very obese or those with local bony deformities were excluded from the study.
All enrolled patients were assessed by preanaesthetic examination. Informed consent was taken. Patients were premedicated with tab. diazepam 5mg orally 1 hour before surgery. Emergency drugs and equipments including facilities for GA were kept ready. Brachial plexus block was performed by supraclavicular approach. Double blind randomization was done. The trial was so planned that neither the doctors (investigator) nor the participants (patients) were aware of the group allocation and drug received. The study drugs were prepared by an anesthesiologist not involved in performing the block, patient care or in data collection. All patients were made to lay supine with head turned to opposite side with ipsilateral arm adducted, all were secured with a 18 G venous cannula in the opposite hand and routine monitors were attached before performing the procedure (pulse oximetry, Non Invasive Blood Pressure, Electrocardiogram).

The anesthetic technique used was subclavian perivascular by using nerve locator. The nerve locator utilized was the Stimuplex DIG (B. Braun, Allentown, PA). A 22-gauge, 2-inch, short-bevel insulated needle (Stimuplex;B. Braun) was used for all blocks, under all aseptic precautions A skin wheal was raised 1 finger breadth over the lowermost palpable portion of the interscalene groove, and the block needle was inserted through it. Then, with the nerve stimulator output set at 0.9 mA at 1 Hz, the needle was advanced directly caudad (parallel to the table) until a flexor or extensor response of all the fingers was obtained, at which point the output was reduced to 0.5 to 0.7 mA. If the response was still visible at this level of stimulation, the local anesthetic solution was injected in 5-mL increments, with repeated aspirations between each increment. 40 ml of local anesthetic solution was injected; the procedure was abandoned if any arterial puncture was noted. The time of administration of drug was noted. Visual and verbal contact with the patient was maintained during and after the injection.

Group C (Control Group) received Inj. Bupivacaine 0.25% - 38 ml + 2 ml normal saline.

Group B (Buprenorphine Group) received Inj. Bupicacaine 0.25% - 38 ml + 2 ml Buprenorphine (0.3 mg).

Patients were given oxygen with nasal mask and they were properly screened from the surgical field. Vital parameters (pulse, respiration, blood pressure) were monitored every 5 min for first 30 min and thereafter every 15 min. till end of surgery post operatively at 2h, 6h, 12h and 24 hrs. Any changes in the pulse, blood pressure, respiratory rate and oxygen saturation were noted.

The following parameters were noted:

- Onset of sensory block- time elapsed between injection of drug and complete loss of cold perception was tested by spirit soaked cotton on skin dermatomes C4-T2.
- Onset of motor block- time elapsed between injection of drug to complete motor block was tested by adduction of shoulder and flexion of forearm and hand against gravity.

Duration of sensory block – time elapsed between injection of drugs to appearance of cold perception.

Duration of motor block- time elapsed between injection of drug to complete return of motor power.

Duration of analgesia – time elapsed between injection of drugs to appearance of pain requiring rescue analgesia.

Pain was assessed by an anaesthesiologist performing the block, who was unaware of the study medications injected. Pain was assessed by numerical rating pain scale where zero represents no pain and 10 means worst possible pain. Duration of pain relief was taken from time of onset of sensory block to time of administration of rescue analgesic. Rescue analgesic was administered when pain score was 4 and above. Inj. diclofenac 75 mg IM was the rescue analgesic. At the end of 24 hours, anaesthesiologist who loaded the drugs revealed the contents of study medications and hence the group to which patient belonged could be notified.

1.2 Statistical analysis: Interval data are expressed as mean and standard deviation. Student’s ‘t’ test was used to compare the two groups. Chi square test was used for analysis of nonparametric data. A p value of < 0.05 was considered statistically significant.

3. Results

The demographic profile of the two groups in terms of age, weight and gender were similar. The surgical profile in terms of duration and type of operation performed were also similar.
Table 1: Demographic data of the patients

| Parameter                  | Group C       | Group B       |
|----------------------------|---------------|---------------|
| Mean age (years)           | 31.10±09.77*  | 35.53±11.76   |
| Mean weight (kgs)          | 55.70±10.11*  | 60.56±09.16   |
| Male:Female                | 19:11         | 22:08         |

* P value >0.05- Statistically insignificant  **P value <0.001- Statistically highly significant

Table 2: Comparison of main outcomes in two groups

| Outcome                        | Group C       | Group B       |
|--------------------------------|---------------|---------------|
| Mean duration of surgery (min) | 68.00±23.72*  | 72.50±16.84   |
| Mean onset of motor block (min)| 04.16±01.20   | 03.83±0.91*   |
| Mean duration of motor block (min)| 297.66±28.21*| 306.33±20.12 |
| Mean onset of sensory block (min)| 06.90±01.32  | 06.46±0.97*   |
| Mean duration of sensory block (min)| 322.16±31.80**| 647.83±55.70 |
| Duration of pain relief (min)  | 343.00±33.02**| 901.33±60.04 |
| Sedation score                | One*          | Three         |
| Numerical rating pain scale score at 12 hours | 5.60** | 1.44 |

The mean onset of sensory block in two groups was equivalent with statistically no significant difference (p>0.05) (06.46±0.97min vs. 06.90±01.32 min). The mean onset of motor block was faster in group B (03.83±0.91min) as compared to group C (04.16±01.20min) but it was not statistically significant (p>0.05). Also the mean duration of motor block was more in group B (306.33±20.12min) as compared to group C (297.66±28.21min) but it was not statistically significant (p>0.05).

Mean duration of sensory block in group B patients was significantly longer (647.83±55.70 min) compared to patients in group C (322.16±31.80min).

Duration of pain relief in group B was significantly longer than in group C (901.33±60.04min vs. 343.00±33.02min). Time to analgesia was more in group B than in group C. In Immediate post operative period and at two hours the pain score was zero in both groups and was comparable. Patients in group B had significantly less pain scores at 6hr, 12hr and 24hrs compared to patients in group B.
Table 3: Numerical Rating Pain Scale Scores

| Time  | Group C | Group B |
|-------|---------|---------|
| 6hr   | 5.12    | 0.24**  |
| 12hr  | 5.60    | 1.44**  |
| 24hr  | 2.84    | 1.56**  |

*P value >0.05- Statistically insignificant  **P value <0.001- Statistically highly significant

Vital parameters like mean pulse rate, systolic blood pressure, mean respiratory rate and mean arterial saturation values were similar in both the groups and did not show any significant fluctuation. No significant side effects like respiratory depression, pneumothorax, signs/symptoms of LA toxicity or neurological sequelae were observed in any of the two groups. 2 cases of tachycardia in C group, and 1 case of pruritis, 2 case of nausea in B group were observed which subsided without any further intervention.

4. Discussion
Pain is an inevitable consequence of surgery. Opioids and nonsteroidal anti inflammatory drugs (NSAIDs) singly or in combination provide good analgesia but cause various side effects.

This prospective, randomized, double blind study was done in patients undergoing upper limb surgery with a similar surgical and demographical profile. A volume of 40 ml of local anaesthetic agent was taken as this volume was associated with a more complete spread for brachial plexus block as found by Winnie and colleagues9. The particular dose of Buprenorphine (0.3 mg) was selected after previous studies10,11. The duration of sensory blockade in our study group was significantly longer than sensory block in control group, this result is comparable with other studies which found no difference in onset of sensory block but found longer duration of blockade8,12. Post operative analgesia was prolonged in buprenorphine group, our study and other studies11,13 came to similar conclusions. With addition of buprenorphine to LA agents the onset and duration of motor blockade are comparable, this finding corroborated with another such studies8,10 .Many studies suggest the action of opioids on peripheral nerves14,15 and the unique mechanism of buprenorphine along with portable local anesthetics effects16 .This suggests the usefulness of peripheral perineuronal route of opiate like buprenorphine administration17 .The easily availability and lack of significant side effects like respiratory depression and sedation makes buprenorphine an attractive choice as an adjuvant for brachial plexus block.

Conclusion
From our study we concluded that buprenorphine as adjuvant to bupivacaine prolonged the duration of analgesia as buprenorphine a opioid have a local anaesthetic type of action by decreasing sodium and potassium conductance, it inhibition of release of substance P from peripheral terminals of primary afferent neurons and it also diffuse from the brachial plexus sheath to the extradural and subaracnoid spaces and then bind with opioid receptors at dorsal horns also receptors present at cell membrane of peripheral nerve axons, without increasing the risk of adverse effects when used for supraclavicular brachial plexus block and is excellent choice for providing post-op analgesia .

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