Original Research Article

Comparative Study between Dexamethasone and Tramadol As an Adjuvant to Ropivacaine Vs Ropivacaine Alone In USG Guided Supraclavicular Block in Upper Limb Surgeries

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Abstract

Background: Brachial plexus block provides superior quality of intraoperative and postoperative analgesia and stable hemodynamics over general anesthesia. Various adjuvants have been used to prolong effects of local anesthetics like epinephrine, midazolam, magnesium sulfate, alpha-2 agonists i.e. Clonidine and dexmedetomidine, dexamethasone and tramadol. Aims & Objective: To compare the efficacy of tramadol and dexamethasone on the characteristics of the block and its effect on postoperative analgesia when added as an adjuvant to ropivacaine in USG-guided supraclavicular brachial plexus block. **Materials & Methods:** Eighty patients belonging to American Society of Anaesthesiologists (ASA) Grade I, II and III, aged between 20 to 55 years, scheduled for undergo elective upper limb surgeries under supraclavicular brachial plexus block were enrolled in this study. Patients were equally divided into two groups : group S received 0.5% ropivacaine 30ml with Dexamethasone 2ml (8mg) and tramadol 2ml (100 mg) And group C received 0.5% ropivacaine 30ml with + normal saline 4ml. Onset and duration of sensory and motor block , duration of postoperative analgesia and any complications were observed. **Results:** In our study both groups were comparable with respect to their demographic profile of patients, duration of surgery and ASA status. Onset of sensory block was earlier in group S than group C (3.15 ± 0.69 minutes and 7.55± 0.89 minutes respectively, p =0.004). Onset and duration of motor block and postoperative analgesia were longer in group S as compared to group C (5.01± 1.33 & 12.32± 0.75 minutes respectively, P= 0.001 and 14.44± 0.635 and 8.24± 0.873 hours respectively, p =0.001 for motor block and 16.53± 0.635 and 10.45 ± 0.681 minutes respectively, p= 0.001for postoperative analgesia). No significant side effects were noted. **Conclusion:** Dexamethasone and tramadol when added to ropivacaine in supraclavicular brachial plexus block prolongs onset and duration of sensory and motor block and postoperative analgesia significantly with minimal side effects.

Key words: Supraclavicular Brachial plexus block, Adjuvant, Dexamethasone, Tramadol and Ropivacaine

Introduction

Brachial plexus nerve block is a good alternative to general anesthesia for upper limb surgeries. This avoids the untoward effects of general anesthetic drugs and upper airway instrumentation. It achieves complete muscle relaxation, intraoperative hemodynamic stability, and postoperative analgesia. These techniques are especially beneficial for patients with various cardiorespiratory comorbities.[1]

Supraclavicular approach to brachial plexus block gives a rapid onset and dense block as it is performed at the level of the brachial plexus trunks which is confined to a very small surface area.[2]

Different drugs have been Co-administred as adjuvants with local anesthetics in brachial plexus block to achieve quick, dense and prolonged block. Co-administration of adjuvants such as epinephrine, α-2 agonists (i.e. clonidine and dexmedetomidine), tramadol, fentanyl or dexamethasone has been used to prolong onset and duration of motor block and postoperative analgesia beyond the pharmacological duration of the local anesthetics.[3,4]

Tramadol and Dexamethasone are selected as adjuvants to local anesthetics in brachial plexus block in this study because respiratory depression is not a major problem with their use. Tramadol has been used as an adjunct to local anesthetic in axillary brachial plexus block and also in caudal anesthesia to extend the duration of postoperative analgesia.[5,6,7] Steroids have nerve block prolonging effects. They block the nociceptive impulse transmission along the myelinated C fibres.[8] Tramadol is an analgesic with mixed μ opioid and non opioid activity. It inhibits the reuptake of nor-epinephrine (NE) and serotonin from the nerve endings and potentiates the effect of local anesthetics when mixed together in peripheral regional nerve block. It has less respiratory depressant effect due to weak μ receptor affinity.[9]

The aim of our study was to compare the efficacy of preservative free tramadol and dexamethasone in terms of onset and duration of sensory and motor block and duration of analgesia when used as an adjuvant to 0.5% ropivacaine in USG-guided supraclavicular brachial plexus block.

Materials & Methods

After obtaining approval from the institutional ethical committee and informed written consent from patients, a prospective randomized double blind study was carried out on 80 patients of American Society of Anesthesiologists (ASA) grade I, II and III of either sex, aged 20 to 55 years scheduled to undergo elective upper limb surgery under USG-guided supraclavicular brachial plexus block. Patients with history of coagulopathy, local infection at injection site, known allergy to local anesthetic or any adjuvants used, hepatic & renal dysfunction, pregnant women, neuromuscular disorder, psychiatric or neurological deficit were excluded from the study.

80 patients were divided into two groups of 40 each as:

Group S (n=40): received 30 ml of 0.5% ropivacaine with preservative free tramadol 2ml (100 mg) + dexamethasone 2 ml (8mg).

Group C (n=40): received 30 ml of 0.5% ropivacaine with + normal saline 4ml.

Preoperatively all patients were familiarized with the Visual Analogue Scale (VAS) for pain assessment and advised about NPO status as per fasting guidelines. On arrival to the operating room, standard ASA monitors were attached namely electrocardiography (ECG), pulse

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oximetry (Sp02), noninvasive blood pressure for measuring systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP). Meanwhile in the nonoperating hand peripheral line secured with a 20-gauge intravenous (i.v.) cannula and Ringer lactate solution was started at a maintaince rate of 5 ml/kg/h.

The supraclavicular block was performed by USG technique using a 6-12 mhz linear probe. Block was performed with patient in supine position, head turned 45 degrees to the opposite side away from the side to be blocked and with the arm to be anaesthetized adducted. With all antiseptic and aseptic precautions, probe was placed in supraclavicular fossa in the coronal plane to locate the first rib, pleura, subclavian artery, brachial plexus and its surrounding structures.

After the skin was sterilized and local anesthetic administered at injection site, by in-plane technique (lateral to the probe and parallel to its long axis) a 5cm insulated needle was inserted and directed in a caudate, slightly medial and posterior direction and block was performed under USG- guidance. By in-plane technique, once the needle pierced the brachial plexus bundle, after negative aspiration of air and blood 34ml of the local anesthetic mixture was administered.

In Group S: 30 ml of 0.5% ropivacaine along with tramadol 2ml (100 mg) + dexamethasone 2ml (8mg) and,

Group C: 30 ml of 0.5% ropivacaine along with 4mLnormal saline. While injecting study drugs local anesthetic dispersion (hydrodissection) was confirmed by USG.

After performance of nerve block patients were evaluated for onset and duration of sensory and motor block, postoperative pain score (VAS), duration of analgesia, & hemodynamic monitoring (HR, NIBP, RR & SPO2).

The **sensory block** was assessed by 3 point sensory score using a atraumatic blunt 25 gauge needle and was graded as,

0 = No block i.e. normal sensation,

1 = Partial block i.e. decreased sensation and,

2 = Complete block i.e. loss of touch sensation or no sensation.

Onset of sensory block: time interval from injection of study drug till complete sensory block (grade 2) was achieved.

Duration sensory block: time interval between the onset of complete sensory block and its complete resolution.

The **motor block** was graded according to three-point modified bromage scale:

0= no block i.e. normal motor function with full flexion and extension of elbow, wrist and fingers.

1 = partial block i.e. decrease motor strength with ability to move fingers only and,

2= total block i.e. complete motor blockade with inability to move fingers

Onset time of motor block: time interval between injection of study drug and achievement of complete motor block.

Duration of motor block: time interval between the onset of the complete motor block and complete resolution of motor block.

The block was considered successful when complete sensory and motor block was achieved within 30 min after injection of the study drug and inadequate block was excluded from the study.

Postoperative analgesia was assessed by the 10 point visual analogue scale (VAS) at 1 hour, 2 hr, 4 hr, 6 hr, 12 hr, 18 hrs & 24hr.

Duration of analgesia: time interval from onset of the complete sensory block to requirement of rescue analgesic (i.e.VAS ≥4).

Visual Analogue Scale (VAS):

0: No pain

8-10: Worst pain

Injection Diclofenac Sodium 75 mg intramuscularly was given when VAS ≥4. Total rescue analgesic requirements in 24 hours were recorded.

Postoperative follow up was carried out in the recovery room and postoperative ward. Any perioperative complications related to the technique or drug such as nausea & vomiting, respiratory depression, pneumothorax if occurred they were recorded and treated accordingly.

The patient's demographic variables (i.e. age, sex, BMI), onset & duration of sensory & motor block, duration of analgesia, duration of surgery were recorded.

The comparison between the two groups with respect to demographic variables was done by unpaired t-test. Intraoperative H.R., BP, RR, SPO2 was analysed by using unpaired t-test. The onset and duration of sensory and motor blocks were compared between two groups using unpaired t-test. P value<0.05 was considered statistically significant.

Result

80 patients were included in the study with 40 patients in each group and they were comparable with respect to their demographic parameters. [Table 1]

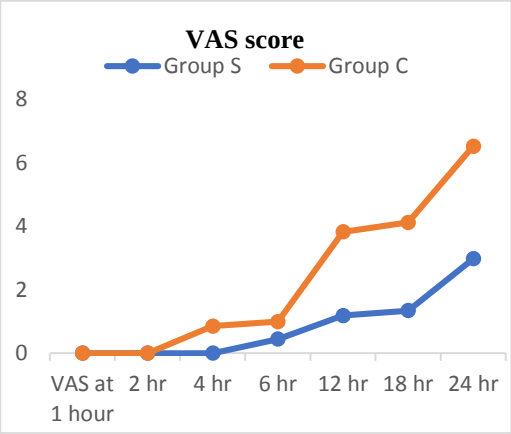
Table I Demographic parameters

variables	Group S (n=40) (mean± SD)	Group C (n=40) (mean± SD)	P- value
Age (years)	35 ± 11.44	33 ± 12.30	0.402
Sex (male: female)	21: 19	23: 17	0.453
BMI (kg/m^2)	26.26 ± 4.51	25.99± 5.52	0.674

Table II Characteristics of supraclavicular block

variables	Group S (n=40) (mean± SD)	Group C (n=40) (mean± SD)	P- value
Onset of sensory block (min)	3.15 ± 0.69	7.55± 0.89	0.004
Onset of motor block (min)	5.01± 1.33	12.32± 0.75	0.001
Duration of sensory block (hours)	12.52± 0.813	8.25 ± 0.632	0.005
Duration of motor block (hours)	14.44± 0.635	8.24± 0.873	0.001
Duration of analgesia (hours)	16.53± 0.635	10.45 ± 0.681	0.001

The onset time of sensory block was earlier in group S as compared to group C (3.15 ± 0.69 minutes and 7.55± 0.89 minutes respectively, p=0.004).The onset time of motor block was also earlier in group S as compared to group C (5.01± 1.33 & 12.32± 0.75 minutes respectively, P=0.001). There was statistically significant difference between the groups in regard to onset time of sensory and motor block. (Table 2)
The duration of sensory block was longer in group S compared to Group C (12.52± 0.813 and 8.25 ± 0.632 hours respectively, p =0.005). The duration of motor block was also longer in group S compared to Group C (14.44± 0.635 and 8.24± 0.873 hours respectively, p =0.001). There was statistically significant difference between the groups in regard to duration of sensory and motor block. [Table 2]
The duration of analgesia was significantly prolonged in Group S as compared to group C (16.53± 0.635 and 10.45 ± 0.681 minutes respectively, p= 0.001). [Table 2]



Graph I shows the visual analog scale (VAS) score which was significantly better in Group S as compared to Group C depicting a longer duration of analgesia in the Group S (P < 0.05)

Table III Duration of surgery, Total Diclofenac consumption & complications

variables	Group S (mean± SD)	Group C (mean± SD)	P- value
Duration of surgery (mins)	120± 20.22	118 ± 21.82	0.552
Total Diclofenac consumption (mg)	75± 50	200± 50	< 0.0001
PONV	0	0	-
LA toxicity	0	0	-
Technical complications	0	0	-

Total Diclofenac consumption was twice in Group C which was stastically significant. The two groups were found to be comparable and insignificant with respect to duration of surgery and baseline hemodynamic parameters. None of the patient develop intraoperative or postoperative complications like PONV, LA toxicity or complications related to block technique.[Table 3]

Discussion

The supraclavicular brachial plexus block serves as sole anaesthetic technique to facilitate painless upper limb surgery. It provides an excellent alternative to general anesthesia especially in patients with uncontrolled diabetes, hypertension, cardiovascular, or respiratory diseases.[10] Brachial plexus block provides complete relaxation of muscles of the upper extremity, thus making approximation of tendons and reduction of fractures easier. It reduces post-operative spasm, pain, and edema due to sympathetic blockade of blood vessels. In 1884, Halsted first operated under brachial plexus block when he exposed the nerve roots in the neck and blocked them with direct application of the cocaine solution.[11]
USG provides an effective and reliable block that has increased safety because of better visualization of anatomy and needle placement.
Longer acting local anaesthetics have been used for brachial plexus block. But still there are certain drawbacks that limits their extended use. Various studies have investigated several adjuncts that prolong the duration of analgesia.
Tramadol has been used as analgesic agent and as adjunct in intrathecal and epidural route. Tramadol is a weak central-acting mu opioid that has been shown to have Na+ and K+ channel blocking properties and can block motor and nociceptive function similarly to local anesthetics[12,13] It inhibits the reuptake of nor-epinephrine and serotonin from the nerve endings and it is supposed to potentiate the effect of local anesthetics when mixed together.
Dexamethasone is a steroid. Steroids have nerve block prolonging effects. Mechanism of action is not clear. But it is suggested from a number of studies that they block the nociceptive impulse transmission along unmyelinated C fibres . They may also have an action on potassium channels causing hyperpolarisation and blocking nerve conduction. Johannson A et al (1990) concluded that local corticosteroid application blocks transmission in normal noceceptive C fibres.[7]
In our study we compared the effects of tramadol 2ml (100mg) and dexamethasone 2ml (8 mg) added to 30ml of 0.5% ropivacaine and effects of 30ml 0.5% ropivacaine added to 4ml saline in USG- guided supraclavicular brachial plexus block, in terms of onset and duration of sensory and motor block, duration of analgesia and side effects. As in our study, Kapral S .et al in 1999 also added 100 mg tramadol as adjunct to local anesthetic.[14] Ali Movafegh et al in 2006, Shrestha BR et al in 2007 and K . C. Cummings et al in 2011 also used 8 mg dexamethasone as an adjuvant.[15,16,17]
In our study the patient demographic variables (age, sex and BMI) were comparable in both groups. The average duration of the surgeries in the both groups were also similar.
More evident from results onset and duration of motor and sensory block and duration of analgesia was significantly prolonged in Group S than Group C, which was stastically significant.
Various studies have explored the use of tramadol and dexamethasone as an adjuvant in brachial plexus block and have agreed that it causes

faster onset of block action and increased both duration of block and analgesia.

Alemanno F et al in 2012 concluded that addition of tramadol to levobupivacaine showed a doubling of analgesia duration after interscalene blocks for total shoulder arthroplasty.[18]

Kaabachi O et al in 2009 concluded that addition of high-dose tramadol to lidocaine plus epinephrine showed an increase in sensory block duration of approximately two hours and time to first analgesic by approximately five hours.[19]

In contrast, multiple publications have shown limited benefit of tramadol added to levobupivacaine plus lidocaine,[20] levobupivacaine alone,[21] and mepivacaine,[22, 23] and no effect when added to ropivacaine [24] and bupivacaine [25].

Choi et al.[26] in April 2013 concluded that dexamethasone prolongs brachial plexus blocks with long-acting local anesthetics from730 to1306 minutes and intermediate-acting anesthetics from168 to343 minutes.

Rasmussen et al.[27] found that when added to ropivacaine, dexamethasone prolonged a range of upper and lower extremity peripheral nerve blocks by a median of 37%.

Although perineurally administered dexamethasone has consistently been shown to prolong analgesia after peripheral nerve blocks, it is not clear that this finding is not due to systemic effects. A recent study by Liuet al. demonstrated that dexamethasone prolonged analgesia by approximately 10 hours compared to a control group for ambulatory shoulder surgery using 0.25%bupivacaine, and this was achieved with perineural doses ranging from 1mg, 2mg, and 4mg of preservative-free dexamethasone.[28]

So our study results are consistent with the previous studies.

Conclusion

From the above results we concluded that addition of tramadol and dexamethasone to local anaesthetics in supraclavicular block:

- Shortens the onset of sensory and motor block.
- Prolong duration of sensory and motor block.
- Provides longer duration of post-operative analgesia.
- Decreased need for postoperative diclofenac as rescue analgesic.
- Hemodynamic stability was maintained perioperatively in all three groups.

Thus, Tramadol and dexamethasone can be used as an adjuvant to local anaesthetic for early onset and prolong duration of analgesia in supraclavicular brachial block prognostic marker should be valued and it should be used religiously in breast carcinoma patients.

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