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A PROSPECTIVE STUDY OF EFFICACY OF DEXAMETHASONE USED AS ADJUVANT TO LEVOBUPIVACAINE ADMINISTERED FOR BRACHIAL PLEXUS BLOCK BY SUPRACLAVICULAR APPROACH FOR UPPER LIMB SURGERY

Anaesthesiology

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ABSTRACT

Many studies have been done on the adjuvants used along with local anaesthetics for Brachial Plexus block. The drug Levobupivacaine has wider margin of safety and has been used in our study along with Dexamethasone as adjuvant. **Method:** We performed a prospective, randomized, controlled, single blinded study on a total of 70 patients who were randomly allocated into two groups namely Group N (Normal Saline) and Group D (Dexamethasone). Both groups received 28 ml 0.5% Levobupivacaine. Group D received 2 ml (8 mg) Dexamethasone as adjuvant while Group N received 2 ml Normal Saline. Onset of Sensory blockade and motor blockade were measured, respectively, by time taken to loss of pin prick sensation and loss of muscle movement, after administration of drug. Duration of sensory block was measured by time till patient first reported pain after sensory blockade. **Result:** The onset time of sensory block was 10.2 ± 1.67 minutes in Group D compared to 12.3 ± 1.88 minutes in Group N (p value <0.0001). The onset time of motor block in Group D was 14.4 ± 1.73 minutes and in Group N 16.3 ± 1.97 min (p value = 0.0002). The duration of sensory block was 944.1± 64.79 minutes in Group D versus 654.7 ± 71.61 min in Group N (p value < 0.0001). **Conclusion:** It was observed that Group D had significantly faster onset of sensory and motor blockade while also experiencing longer duration of analgesia.

KEYWORDS

dexamethasone, levobupivacaine, brachial plexus block, comparative study.

INTRODUCTION

The Brachial Plexus is formed by the Ventral Rami of C5 to T1 spinal nerves with minor contributions from C4 and T2. These nerve roots enter the inter-scalene groove between the scaleneus anterior and scaleneus medius muscle. These nerve roots form the upper, middle and lower trunks. Each trunk has its anterior and posterior divisions. [1]

Local anesthetics alone for Supraclavicular brachial plexus block provide good operative conditions but have shorter duration of postoperative analgesia. So various adjuvant like morphine[2], buprenorphine, epinephrine[2] , dexmedetomidine[2], magnesium[2] clonidine[2,3,4], fentanyl[5], tramadol[6] and neostigmine[7], etc. were added to local anesthetics in brachial plexus block to achieve quick, dense and prolonged block, but the results are either inconclusive or associated with serious side effects e.g. Respiratory depression with opioids.[2-7] Glucocorticoids have powerful anti-inflammatory as well as analgesic property.

Perineural injection of corticosteroid along with local anesthetics is reported to influence the onset and duration of sensory and motor block. They suppress inflammation through inhibition of phospholipase A2. Corticosteroids have been found to block nociceptive transmission in unmyelinated C-fibers.[8] The effect was reversible, suggesting a direct membrane action of steroids.[8] Corticosteroids also suppress ectopic neuronal discharge.[9]

Dexamethasone is a very potent and highly selective glucocorticoid. Various studies have been done using dexamethasone 8 mg as an adjuvant to local anaesthetics mixture in brachial plexus block.[10,11]

Levobupivacaine is S(-) enantiomer of racemic Bupivacaine with less cardio toxicity and neurotoxicity.[12]

MATERIAL AND METHODS

The aim of our study was to compare the onset and duration of sensory and motor block between Group D and Group N after Brachial Plexus block. After obtaining institutional ethics committee approval and patient consent, the patients were randomly allocated into two groups of 35 each. The patients included in the study were those aged 18 to 45 years, ASA I, Mallampati score 1 and 2, body weight 45 to 60 kg, scheduled to undergo elective upper limb surgery below the shoulder level under Brachial Plexus block were assessed in this study.

The exclusion criteria are any criteria more than inclusion criteria; to mention especially pregnancy, patient taking multiple medicines for comorbidities like cardio respiratory diseases, hypertension and coagulation disorder.

Group D received 28 ml 0.5% Levobupivacaine + 2 ml (8mg) Dexamethasone. Group N received 28 ml 0.5% Levobupivacaine + 2 ml 0.9% Normal Saline.

A thorough preanaesthetic check-up was done and routine informed risk consent was taken. Fasting for 6 hours before surgery was suggested. Oral Alprazolam 0.5 mg was given night before surgery. On the OT table a 20G iv cannula was secured on the non-operative hand and Ringer Lactate infusion was started. After proper aseptic dressing and draping, patient was placed supine with head turned to contra lateral side and the upper limb to be anesthetized was adducted and extended along the side towards the ipsilateral knee as far as possible.

Supraclavicular block is performed in this study by technique using nerve stimulator needle. Anterior scalene muscle, middle scalene muscle and midpoint of the clavicle were identified and marked. The posterior border of sternocleidomastoid muscle was palpated easily when the patient raised the head slightly. The palpating fingers then rolled over the belly of anterior scalene muscle into the interscalene groove at the level of cricoid cartilage, where a mark was made approximately 1.5 to 2.0 cm posterior to the midpoint of clavicle.

This mark was the needle entry point. 3 ml of 2% Lignocaine (preservative free) was infiltrated subcutaneously at this mark using a hypodermic syringe.

Nerve stimulator (Stimuplex ® DIG RC) was switched on, it's one wire was connected to disposable silver chloride electrode attached on patient's forearm and the other wire was connected to Stimuplex A needle (22 G × 5 cm, insulated needle).

The stimulation frequency was set at 1 Hz and the intensity of the stimulating current was initially set to deliver 2 mA. The 22-gauge 5 cm, insulated, Stimuplex **A** needle was then inserted at that marked point, while carefully avoiding accidental puncture of subclavian artery, and advanced in a caudad, slightly medial and posterior direction until a slight distal motor response was elicited or the first rib was encountered. The position of the needle was considered to be acceptable when an output current < 0.5 mA still elicited a slight distal motor response in forearm and hand. In case, the first rib was encountered without elicitation of distal motor response the needle was systematically walked anteriorly or posteriorly along the rib until the plexus was located. If twitching of diaphragm occurred then the

needle was withdrawn and reinserted 15 degrees posterior and lateral.

On localization of the brachial plexus, aspiration for blood was performed before incremental injections of a total volume of 30 ml solution (28 ml 0.5%Levobupivacaine + 2 ml dexamethasone or normal saline) according to the group.

Sensory and motor blockade were assessed every 3 minutes for the next 21 minutes. After adequate block was achieved surgical procedure was initiated. Sensory blockade of each nerve was assessed by pinprick and evaluated using a 3-point scale where: 2 = normal sensation, 1 = loss of sensation to pinprick, and 0 = loss of sensation to light touch. Motor block was tested by thumb abduction and wrist extension (radial nerve), thumb adduction and ulnar deviation of the hand (ulnar nerve), flexion of the elbow in supination (musculocutaneous nerve), thumb opposition and wrist flexion (median nerve) and was measured using a 3- point scale where: 2 = normal movement, 1 = paresis, and 0 = absent movement. Onset time of sensory block was defined as the time interval between the end of local anesthetic injection and loss of sensation to pinprick in all of the nerve distributions. Onset time of motor blockade was defined as the time interval between the end of local anesthetic injection and paresis (motor score = 1) in all of the nerve distributions.

The duration of sensory block was defined as the time interval between the onset of sensory block and the first postoperative pain. The duration of motor block was defined as the time interval between the onset of motor block and complete recovery of motor functions. The anesthesiologist who assessed the sensory and motor blockade was blinded to group allocation and drug used.

Loss of sensation to pinprick and muscle paresis in each of the radial, ulnar, median, and musculocutaneous nerve distributions, achieved within 20 minutes of local anesthetic injection, were considered as criteria for successful block. Patients with unsuccessful block were excluded from the study. Any side effects were treated accordingly.

The time of occurrence of first postoperative pain and the time of complete recovery of motor functions of the forearm and hand were recorded in every patient. Injection Diclofenac sodium (rescue analgesic) 75 mg was given intramuscularly when Visual analogue scale score for pain was > 30 mm.

Numerical variables have been compared between groups by Student's Unpaired t-test and Mann-Whitney U test. All analysis has been two tailed and $p < 0.05$ has been taken to be statistically significant.

Software used were Statistica version 6 [Tulsa, Oklahoma: StatSoft Inc., 2001] and GraphPad Prism version 5 [San Diego, California: GraphPad Software Inc., 2007]

RESULT

Total 70 patients were screened initially. After matching the inclusion and exclusion criteria total number of 60 patients was studied and none of them were discontinued during study.(Fig 1)

Assessed for Eligibility (n=70)	
Did not meet inclusion criteria (n=2) Refused to participate (n=2)	
Total subjects 66	
Allocation of study subjects as per computer generated random numbers	
Allocated in group N (n=33)	Allocated in group D (n=33)
Incomplete Block (General Anaesthesia administered so excluded) = 2 Non-cooperation during block = 1	Incomplete Block (General Anaesthesia administered so excluded) = 1Accidental vascular penetration = 2
Analyzed n=30	Analyzed n=30

Table 1: Demographic parameters and duration of surgery

Demographic data	Group N	Group D	P value
Age (years)	**32.7 ± 11.97**	**31.3± 11.10**	**0.624**
Sex- M/F	**16/14**	**13/17**	**0.792**
Height (cm)	**160.6 ± 6.69**	**160.9± 7.04**	**0.851**
Weight (kg)	**61.9 ± 7.00**	**63.3 ± 6.94**	**0.451**
ASA status- I	**30**	**30**	**0.771**
Duration of surgery (minute)	**115.4± 19.43**	**119.1± 17.08**	**0.436**

Table 2: Onset time of sensory and motor block

Onset time (minutes)	Group N (mean ± SD)	Group D (mean ± SD)	P value
Onset time of sensory block	12.3 ± 1.88	10.2± 1.65	<0.0001
Onset time of motor block	16.3± 1.97	14.4± 1.73	=0.0002

Table 3: Duration of sensory and motor block

Duration of block (minutes)	Group N (mean ± SD)	Group D (mean ± SD)	P value
Duration of sensory block	654.7 ± 71.61	944.1 ± 64.78	**<0.0001**
Duration of motor block	547.7 ± 73.93	815.7 ± 66.73	**<0.0001**

DISCUSSION

The brachial plexus block is very renowned for its anaethsesia and analgesia effect. In the year 1885 the famous surgeon William Halsted demonstrated brachial plexus block for the first time by infiltration of cocaine around the brachial plexus [13]. In January 1900, Harvey Cushing, one of Halsted's surgical resident applied cocaine infiltration in brachial plexus before forequarter amputation of sarcoma.[14]. The first percutaneous supraclavicular brachial plexus block was performed in 1911 by German surgeon Diedrich Kulenkampff.[15]

The brachial plexus block is very cost effective and very much useful in upper limb surgeries especially orthopedic and plastic surgeries. The block is performed at the level of Division. Higher volumes of local anaesthetic are required to block up to the trunk level. The local anaesthetics mainly the Lignocaine hydrochloride and Bupivacaine hydrochloride were being used commonly so far. Due to high volumes used they pose risk of vascular instability and cardiac side effects like bradycardia, hypotension, nausea, vomiting etc.[2,3,4] The use of Levobupivacaine decreases the probability of these side effects due to its safer pharmacological profile.[12] Moreover the use of many adjuvants along with the local anaesthetic agents decreased the need for high volume of local anaesthetics required to block the brachial plexus in supraclavicular, interscalene approach. Here we used Dexamethasone as adjuvant [6]. Perineural injection of corticosteroid along with local anesthetics is reported to influence the onset and duration of sensory and motor block.[6] They suppress inflammation through inhibition of phospholipase A2 [9]. Use of mixture of Levobupivacaine and Dexamethasone, which are low cost drugs, provided excellent anaesthesia.

The onset time of sensory block (10.2 ± 1.67minutes) in dexamethasone group is faster than in control group (12.3 ± 1.88 minutes) (p value <0.0001). The onset time of motor block (14.4 ± 1.73 minutes) in dexamethasone group is also faster than N group (16.3 ± 1.97 min in control group) (p value = 0.0002).

In our study, the duration of sensory block (944.1± 64.79 minutes in dexamethasone group versus 654.7 ± 71.61 min in control group) was significantly longer in the dexamethasone group than in the control group (p value < 0.0001). The duration of motor block (815.7 ± 66.73 minutes in dexamethasone group versus 547.7 ± 73.93 minutes in control group) was also significantly longer in the dexamethasone group than in the control group (p value < 0.0001).

LIMITATION

Optimum dose of the adjuvants should be found after research work so as to administer them with minimum side effects. A double blind study will offer a better result. The heart rate and blood pressure charts are not included in the study.

CONFLICT OF INTEREST: None
FUNDING: Nil
ETHICAL APPROVAL: Approved by institutional ethics committee.

CONCLUSIONS

So to conclude the Levobupivacaine and Dexamethasone combination is more effective in comparison to control group as it provides quicker onset of sensory and motor block and longer duration of analgesia.

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