Supraclavicular Brachial plexus block using Lidocaine with Adrenaline and Dexomethasone as an adjunct – A study on 60 cases

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ABSTRACT

Introduction: Steroids are very potent anti inflammatory and immunosuppressive agents. They are used in various inflammatory and allergic conditions in various medical and surgical diseases. Study was undertaken to compare the effect of addition of dexamethasone as an adjunct to local anaesthetic in brachial plexus block on the onset time and duration of block.

Materials and methods: The study was done on patients undergoing elective upper limb surgeries, aged between 18-60 years were randomly allocated into two groups of 30 each. Group A were received 7mg/kg of 1.5% lidocaine with adrenaline with 2ml 0.9% normal saline and Group B received 7mg/kg of 1.5% lidocaine with adrenaline with 2ml (8mg) dexamethasone. Sensory and motor blockade were recorded at an interval of 5, 15, 30min, and post operatively every 15min till the complete sensory and motor recovery.

Results: Both the onset of sensory and motor blockade was earlier in dexamethasone group than control group (sensory 636 ± 56.48 sec versus 678 ± 65.72 seconds, motor 698.33 ± 54.33 sec versus 740 ± 66.38 sec) and both the duration of sensory and motor block was prolonged in dexamethasone group than control group (sensory 230.00±13.37 min versus 150.50±12.45 min, motor 243.50±13.49min versus 172.50±13.03 min .

Conclusion: We conclude that dexamethasone as an adjunct administered with lidocaine with adrenaline in brachial plexus block produces early onset of sensory and motor blockade, prolongs duration of both sensory and motor blockade, with out any side effects.

Key words: Local anaesthetic, lidocaine, dexamethasone, adrenaline, brachial plexus

INTRODUCTION

Brachial plexus blockade for upper limb surgeries is advantageous as the effect of drug is limited to the part of the body to be operated upon. It is devoid of complications associated with general anaesthesia like nausea, vomiting, aspiration pneumonitis, urinary retention etc. It also provides early oral feeding and ambulation thus reducing post operative complications and hospital stay. It produces dense anaesthesia with good muscle relaxation, thus satisfying surgeon.

Supraclavicular brachial plexus block provides anaesthesia for surgeries around elbow, forearm and hand. As it provides dense block and also relieves tourniquet pain, this technique was chosen for upper limb surgeries in our study. Though few potential complications like pneumothorax, injury to vessels, hematoma are described with this technique, it can be minimized with proper technique and strict vigilance.

MATERIALS AND METHODS

A controlled prospective clinical study was carried out on 60 patients of either sex undergoing various orthopaedic surgeries of upper limb under supraclavicular brachial plexus block using 1.5% lidocaine with adrenaline (1:200000) with and without addition of Dexamethasone was done for a period of 3 years from 2008 – 2011. Surgeries around elbow, forearm and hand were included in the study. The Patients included in the study belonged to American Society of Anaesthesiologista (ASA) physical status I and II. Both elective as well as emergency procedures were included. Patients in the age group of 18-60 years were included in the study.

All patients underwent a thorough pre-anaesthetic check up which included history taking, general and systemic examination.

Routine investigations like Hemoglobin, urine examination, blood sugar, blood urea, serum creatinine, bleeding time and clotting time were carried out for all patients. Special investigations like ECG, Chest X-Ray, was asked if required.

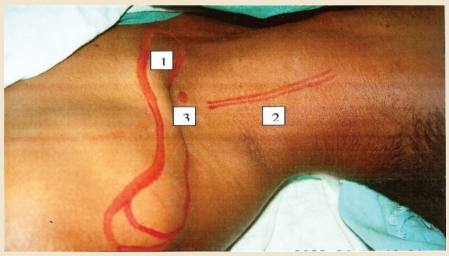
Patients with known hypersensitivity to local anaesthetic drugs ,Bleeding disorders ,Uncontrolled Diabetes mellitus, Renal and Liver diseases,Circulatory instability ,Pregnant women,Patients with epilepsy and peptic disease,ASA grade III & above were excluded from the study.

Under aseptic precaution brachial plexus block was performed by supraclavicular approach (classical), the patient was made to lie in supine position with both the arms adducted and straight. Head was turned away from the side to be blocked and the arm adducted with hand extended towards the ipsilateral knee, a small roll of towel placed between the shoulder blades to make the plexus taut.

The mid point of the clavicle was identified and marked. The point of entry was the lateral border of anterior scalene muscle, approximately 1.5 to 2 cm posterior to the mid point of clavicle was also marked. One can confirm the land mark by palpating the subclavian artery at this point.

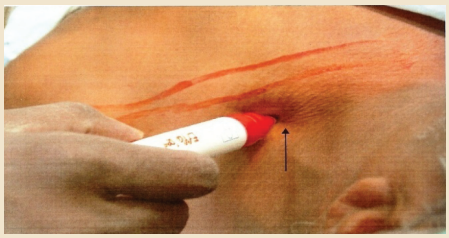
After antiseptic painting and draping, a skin wheal was raised with local anaesthetic. 22G needle was inserted at the point of entry above the mid point of clavicle in the caudal-posterior- medial (CPM) direction. Paraesthesia in the forearm or hand was elicited. After negative aspiration for air or blood appropriate drugs were injected.

Fig.1. Land marks for brachial plexus blockade –



1.Clavicle 2.External carotid artery 3.Subclavian artery pulsations

Fig.2



Arrow shows site for the entry of needle

Fig.3.

Procedure for intercostobrachial nerve blockade

Group A (n=30) received 7mg/kg of 1.5% lidocaine with adrenaline (1:200000) with 2ml 0.9% normal saline.Group B(n=30) received 7mg/kg of 1.5% lidocaine with adrenaline (1:200000) with 2ml(8mg) Dexamethasone. A separate 5ml injection of 1.5% plain lignocaine was made for an intercostobrachial nerve block in the axilla to provide anaesthesia for application of tourniquet.Both the groups will be given intravenous Inj.Midazolam 0.03-0.05mg/kg IV, as sedation.

Sensory and motor blockade of radial, median, musculocutaneous and ulnar nerves were recorded at an interval of 5, 10, 15, 30min.Assessment of sensory block was done after completion of drug injection Sensory blockade of each nerve was assessed by pinprick and compared with the same stimulation on the contralateral hand in skin areas corresponding to median nerve, radial nerve, ulnar nerve and musculo- cutaneous nerve.

Radial nerve – Dorsum of hand at base of index finger ,Median nerve – Palmar base of index finger

Ulnar nerve – Palmar base of little finger ,Musculocutaneous nerve – Along lateral border of forearm over site of radial artery.Sensory blockade was rated by the patient verbal analog scale from

100% (normal sensation) to 0% (no sensation).

Rating Scale for Quantification of Muscle Force

6 - Normal muscular force

5 - Slightly reduced muscular force

4 - Pronounced reduction of muscular force

3 - Slightly impaired mobility

2 - Pronounced mobility impairment

1 - Almost complete paralysis

0 - Complete paralysis

Thus block was considered completely effective when all segments supplied by median, radial, ulnar and musculocutaneous nerve had anaesthesia (Analgesia + Paralysis).The block was considered incomplete – when any of the segments supplied by median, radial, ulnar and musculocutaneous nerve did not had analgesia or anaesthesia even after 30 minutes of drug injection and it was considered Failure – when more than one nerve remained unaffected.

The onset time of the sensory and motor blockade was defined as the time between the end of last injection and the total abolition of the pinprick response and complete paralysis in all of the nerve distributions.The duration of sensory block was considered as the time interval between the administration of the local anesthetic and the first

postoperative pain, and the duration of motor block was defined as the time interval between the local anesthetic administration and complete recovery of motor functions.

Intra-operatively patients were monitored for hemodynamic variables such as Pulse rate, Blood pressure and Respiratory rate. Assessment of blood loss was done and fluid was administered as per the loss. Duration of surgery was noted.Post-operatively pulse, blood pressure, respiratory rate, consciousness and response to verbal commands were noted. Patient were evaluated post operatively every 15min till the complete sensory and motor recovery. The side effects and complications if any like nausea, vomiting, pneumothorax, hematoma and local anaesthetic toxicity were monitored for 6hrs postoperatively in all patients.

RESULTS

In the present study males contributing 64% in group – A and 66% in group – B, whereas females are 36% in group-A and 34% in group-B . As shown in table 1 age and weight were comparable in both the groups with no statistically significant difference.

Table-1: Demographic Data

Parameter	Group-A	Group-B	P value
Number of patients	30	30	
Age (years) (mean ± SD)	30.43± 8.93	32.66 ± 7.50	>0.05
Sex (M:F)	19:11 (64%:36%)	20:10(66%:34%)	
Weight (KGs)	58.46 ± 6.41	58.10 ± 6.03	>0.05

The mean time for Peak effect of Sensory blockade was 678 ± 65.72 seconds in group-A and 636 ± 56.48 seconds in group-B (P <0.05) and thus statistically significant.

Group-B patients had marginally significant early Peak effect of Sensory block compared to group-A patients.

Table 2& 3 showing results of onset time for sensory and motor block.

Table – 2: Onset time for Sensory block

Time (seconds)	Group – A	Group – B	P value
< 360	0	0	
361 – 480	0	0	
481 – 600	6	13	
601 – 720	19	16	
721 – 840	5	1	
> 840	0	0	
Mean ± SD	678 ± 65.72	636 ± 56.48	<0.05

Table – 3: Onset time for Motor block

Time (seconds)	Group – A	Group – B	P value
< 360	0	0	
361 – 480	0	0	
481 – 600	0	0	
601 – 720	15	23	
721 – 840	13	7	
> 840	2	0	
Mean ± SD	740 ± 66.38	698.33 ± 54.33	<0.05

The mean time for peak effect of Motor blockade was 740 ± 66.38 seconds in group-A and 698.33 ± 54.33 seconds in group-B (P <0.05) and thus statistically significant

Group-B patients had marginally significant early peak effect of Motor blockade compared to group-A patients.

The mean time for total duration of sensory block was 150.50±12.45 min in group-A and 230.00±13.37 min in group-B (P <0.001) and Total duration of motor block was 172.50±13.03 min in group A and 243.50±13.49 min in group B (P <0.001)

Thus Group-B patients had statistically significant prolonged duration of both sensory and motor blockade compared to group-A patients.

Table 4: Comparison of Duration of Block

Study parameters	Group-A	Group-B	P value
Total duration of sensory block(min)	150.50±12.45	230.00±13.37	<0.001**
Total duration of motor block(min)	172.50±13.03	243.50±13.49	<0.001**

DISCUSSION

Peripheral nerve blocks with local anaesthetics provides excellent operating conditions with good muscle relaxation but the duration of analgesia is rarely maintained for more than 2-3 hours even with the longest acting local anaesthetics (Bupivacaine, Ropivacaine and levo-bupivacaine) .Continuous infusion of local anaesthetics into brachial plexus sheath requires an infusion pump and has potential for cumulative toxicity and unpredictable variability in absorption. So there had been search for a method, which can provide longer duration of analgesia without the above side effects and inconvenience to the patient

Various studies has shown that addition of various analgesics like Clonidine, tramadol, buprenorphine, fentanyl to local anaesthetic mixture in peripheral nerve blocks significantly prolonged the duration of analgesia[1]. Steroids are very potent anti inflammatory and immunosuppressive agents.

They are used in various inflammatory and allergic conditions in various medical and surgical diseases.

Since 1952, Epidural steroids were used for treatment of back pain and sciatica (Robechhi A.et.al). Methyl prednisolone was used intrathecally in treatment of multiple sclerosis (Baker AG)[2]

Various steroids have been used for this purpose, but Dexamethasone having a potent anti-inflammatory property without any mineralocorticoid activity and thus has found to be safer and devoid of potential side effects is preferred. Dexamethasone is a 9a-derivative synthetic glucocorticoid with highly potent anti- inflammatory property being 25-30 times more potent as hydrocortisone and without any mineralocorticoid activity.

Pre- operative administration of Dexamethasone by oral and intravenous routes has been shown to reduce overall pain scores and analgesic requirements in the post-operative period without any adverse effects in various oral and general surgical procedures, Dexamethasone is also known to reduce post-operative nausea and vomiting (Baxendale BR.et.al,[3] Bisgaard.et.al[4], Elhakim.et.al[5]

The possible mechanism of analgesic and antiemetic actions are due to anti- inflammatory property of Dexamethasone.

Corticosteroids are capable of reducing prostaglandin synthesis by inhibiting phospholipase A2 through the production of calcium dependent phospholipid binding proteins called Annexins and by the inhibition of cyclo-oxygenase-2 during inflammation. Various preliminary studies have demonstrated that addition of corticosteroid micro spheres to local anaesthetics prolonged the duration of blockade of peripheral nerves.

One of the prime concerns of anaesthesiologist is the risk of aspiration pneumonitis, which may be a possibility in emergency procedures. Regional anaesthesia of upper limb has a great potential in emergency and out patient departments, where the status of nil per oral is at doubt and thus risk of aspiration likely. It is also useful in high risk patient groups having co-existing Diabetes mellitus, Cardiac, Hepatic, Renal disease and poly-trauma where general anaesthesia may be associated with increased risk of morbidity. Supraclavicular block is a simple, easy to administer and economical technique. It produces an effective block and excellent analgesia. With this technique the land marks are easy to locate and tourniquet pain is better tolerated.

Patient remains conscious without any depression of protective airway reflexes. It provides optimal operative conditions to surgeons with good muscle relaxation, excellent surgical field and co-operation of the patient. It permits early ambulation and oral feeding with reduced recovery room admissions.

The early onset of action of Dexamethasone may be due to its synergistic action with Local anaesthetics on blockade of nerve fibers.

The mechanism of blockade prolonging effect of Dexamethasone is not clearly understood. The block prolonging effect may be due to its local action on nerve fibres and not a systemic one (Drager et.al)[6]. The effect might be mediated via glucocorticoid receptors. When steroids were used as sole agent in regional blocks the blockade was not produced. Steroids might bring about this effect by altering the function of potassium channels in excitable cells[7]

In our study Dexamethasone produced a relatively rapid onset which cannot be explained by the above mechanism of action. Therefore vasoconstriction the presumed mechanism of action of epinephrine adjuvant effect on local anaesthetics is probably not responsible for block prolonging effect of Dexamethasone Thus the exact mechanism of prolonged duration of analgesia when Dexamethasone is used as an adjuvant to local anaesthetic mixture is uncertain. Proposed possible theories are attributed to anti-inflammatory property and its local action on nerve fibres.

Patients were observed for complications like nausea, vomiting, pneumothorax, hematoma, post block neuropathy, local anaesthetic toxicity. No other significant complications were observed in both groups,

Steroids are very potent anti inflammatory and immunosuppressive agents. They are used in inflammatory and allergic conditions in various medical and surgical diseases.

In conclusion, the addition of dexamethasone as an adjunct to 1.5% Lidocaine with adrenaline (1:200000) in supraclavicular brachial plexus block produces early onset of sensory and motor blockade, prolongs duration of both sensory and motor blockade, with out any side effects.

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