

EFFECT OF ADDITION OF DEXAMETHASONE TO LOCAL ANAESTHETIC AGENTS ON ON SET OF SENSORY AND MOTOR BLOCKADE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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Abstract

Background: Brachial plexus block provides excellent anaesthesia and analgesia for upper limb surgeries. It was found that when dexamethasone was added as an additive to local anaesthetic agent, it shortens the onset of sensory and motor blockade. This study was carried out to compare the onset of sensory and motor blockade on addition of dexamethasone to local anaesthetics versus local anaesthetics only in supraclavicular brachial plexus block.

Materials and Methods: This was a prospective, randomized and controlled study conducted on 60 ASA class I & II physical status patients undergoing elective upper limb surgery after obtaining approval of Institutional Ethics Committee. After written informed consent, patients were randomly allocated to two groups i.e. Group A and Group B of 30 each. Group A (control) received lignocaine with adrenaline 14 ml and bupivacaine 16 ml. Group B (study) received lignocaine with adrenaline 14 ml and bupivacaine 16 ml along with dexamethasone 4 mg. Time for onset of sensory and motor blockade was recorded.

Result: The average age of the patients was 33.401 ± 9.1 years in Group A and 35.101 ± 6.8 years in Group B. The average weight of the patients was 60.411 ± 3.4 kg in Group A and 63.349 ± 4.1 kg in Group B respectively. Both groups had predominantly male patients accounting for nearly two third of the total study population in each group. The difference in age, weight and sex distribution was statistically insignificant. The observed average time for onset of sensory blockade was 10.18 ± 0.87 minutes in Group A and 8.24 ± 0.72 minutes in Group B. The average time for onset of motor blockade was 12.11 ± 3.52 minutes in Group A and 10.51 ± 2.38 minutes in Group B.

Conclusion: Dexamethasone when added to local anaesthetic agents in supraclavicular brachial plexus block significantly shortens the onset of sensory and motor blockade without any untoward side effect.

Keyword: Dexamethasone, anaesthetic, supraclavicular, brachial

Introduction

Cocaine was the first local anaesthetic extracted from *Erythroxyton coca* by Niemann. Carl Koller later brought into light the anaesthetic properties of Cocaine by insensitizing the frog's and rabbit's cornea with Cocaine ^[1]. In search of better local anaesthetic than cocaine derivatives, which were labile, short acting, produced allergic reactions, the amino-amide derivatives were synthesized. Lofgren and lundqvist in 1943 synthesized Lidocaine. It was brought into clinical practice by Gordh in 1947 ^[2, 3]. Ekenstam pioneered the synthesis of chain of amino-amides Bupivacaine, Mepivacaine and Ropivacaine. Telivuo introduced Bupivacaine, a long acting local anaesthetic to clinical practice in 1963 ^[2, 3, 4].

Brachial plexus was first blocked by William Stewart Halsted in 1884 using cocaine. He blocked the nerve roots and separated the cords and nerves later ^[5]. Crile disarticulated the shoulder joint by blocking nerve trunks under direct vision ^[6]. It was Hirschel in 1911 who described percutaneous technique for blocking plexus by making separate injections above and below the axillary artery using four-inch needle directed towards the apex of axilla ^[7].

Brachial plexus provides the motor innervation and nearly all sensory supply of the upper limb. The plexus is constituted by the anterior primary rami of fifth, sixth, seventh, eighth cervical and first thoracic nerves. Sometimes the plexus is derived mainly from fourth to eighth cervical nerve (prefixed plexus) or from sixth cervical nerve to second thoracic nerves (postfixed plexus). The components are designated according to their location as roots, trunks, divisions, cords and branches. Roots after emerging from intervertebral foramina unite to form trunks between scalene muscles. Each trunk divides into anterior and posterior divisions. The divisions on combination form cords which surround the axillary artery ^[8].

Brachial plexus block by supraclavicular approach is the most commonly practiced peripheral nerve block for upper limb surgeries due to high success rate and ability to provide prolonged post-operative analgesia ^[9]. But the onset of action of the block is prolonged when local anaesthetic agents are used alone. High volume and high dose of local anaesthetic agents used to expedite the onset of action of the block increase the risk of local anaesthetic systemic toxicity. Hence, search of an adjuvant to local anaesthetic agent to hasten the onset of action of the nerve block is going on continuously ^[10].

Corticosteroids have shown analgesic properties when used for nerve block due to local action and not due to systemic absorption. Recently dexamethasone has been studied extensively for peripheral nerve block as an adjuvant to local anaesthetic agent. Dexamethasone is found to be safe without untoward side effects when used as an adjuvant to local anaesthetics in peripheral nerve block. Hence, dexamethasone was selected as an additive to local anaesthetic agent for study of its effect on the onset of sensory and motor blockade in supraclavicular brachial plexus Block ^[10, 11, 12].

Material and Methods

This was a prospective, randomized and controlled study conducted at a tertiary care teaching hospital after approval of Institutional Ethics Committee. After written informed consent, 60 patients admitted over a period of 6 months undergoing elective upper limb surgery lasting for more than 90 minutes were included in the study. The elective surgical interventions were open reduction and internal fixation of bones with plates and screws, excision of bone cysts, reconstructive and other surgeries involving upper limb.

Inclusion criteria

1. Either gender patients with American Society of Anesthesiologists (ASA) class I and II physical status

2. **Age group:** 18 to 60 years
3. **Height:**> 150 cm
4. **Weight:**> 50 kg
5. Elective upper limb surgeries below shoulder joint

Exclusion criteria:

1. Patients of age less than 18 years and greater than 60 years.
2. Patients with coagulopathy or on anti-coagulants.
3. Patients with peripheral neuropathy.
4. Patients with history of substance abuse and local cutaneous infections.
5. Pregnant and lactating female patients
6. Patients in renal failure, hepatic failure and patients with respiratory distress.
7. Diabetes mellitus and peptic ulcer patients
8. Patients with allergy to local anesthetics or dexamethasone.
9. ASA class III and IV physical status patients.
10. Uncooperative patients.
11. Patchy or inadequate anesthesia.
12. Patients undergoing emergency surgical procedures.

Detailed pre-anaesthetic checkup was carried out for all patients as per protocol. All patients were kept overnight fasting. Patients were randomly allocated to two groups i.e. Group A and Group B of 30 each. Supraclavicular brachial plexus block was performed under ultrasound guidance. Group A (control) received lignocaine with adrenaline 14 ml and bupivacaine 16 ml. Group B (study) received lignocaine with adrenaline 14 ml and bupivacaine 16 ml along with 4 mg dexamethasone. The patients were adequately monitored peri-operatively.

The time interval from injection of local anaesthetic to the onset of analgesia in major peripheral nerves distribution i.e. ulnar, radial, median and musculocutaneous was taken as the onset of sensory block. It was assessed using pinprick of a blunt 27G needle at duration of 0,5,6,7,8,9,10,11,12,13,14,16,18 and 20 minutes by 3-point scale:-

1. Normal sensation.
2. Decreased sensation.
3. Complete loss of sensation.

The onset of motor block was assessed at 0,5,6,7,8,9,10,11,12,13,14,16,18 and 20 minutes by assessing flexion at the elbow for musculocutaneous nerve, extension at elbow and wrist for radial nerve, opposition of thumb and index finger for median nerve and opposition of thumb and small finger for ulnar nerve.

Modified three point Bromage score was used for assessment of motor blockade:-

1. Normal power.
2. Decrease in motor strength with ability to move fingers only.
3. Complete motor block with inability to move fingers.

Results

Table 1: Comparison of Demographic parameters

Demographic parameters Mean \pm SD	Group A (n=30)	Group B (n=30)	P value
Age in years	33.401 \pm 9.1	35.101 \pm 6.8	0.570

Weight in kg	60.411±3.4	63.349±4.1	0.211
Sex	Male = 21 (70.00%)	Male = 19 (63.33%)	0.780
	Female = 09 (30.00%)	Female = 11 (36.66%)	
Inference	Age, sex and weight of both groups matched (P>0.05)		

The above table shows that the average age of the patients was 33.40±9.1 years in Group A and 35.10±6.8 years in Group B. The average weight of the patients was 60.341±3.4 kg in Group A and 63.349±4.1 kg in Group B respectively. Both groups had predominantly male patients accounting for nearly two third of the total study population in each group.

The difference in age, weight and sex distribution was statistically insignificant.

Table 2: Comparison of Study Parameters between two Groups

Study Parameter	Group A (n=30)		Group B (n=30)		P Value
	Mean	SD	Mean	SD	
Onset of Sensory blockade (Minutes)	10.18	0.87	8.24	0.72	< 0.05
Onset of Motor blockade (minutes)	12.11	3.52	10.51	2.38	< 0.05

In the above table, observed average onset of sensory blockade was 10.18±0.87 minutes in Group A and 8.24±0.72 minutes in group B. The average time of onset of motor block was 12.11±3.52 minutes in Group A and 10.51±2.38 minutes in Group B. The reduction in time for onset of sensory and motor blockade was statistically significant (p= < 0.05) in Group B.

Discussion

A wide variety of receptors mediate nociception in peripheral nerve fibres. The knowledge of these receptors has been utilized for addition of various adjuvants to local anaesthetic agents for enhancement of the effect. These adjuvants not only shorten the onset of action but also prolong the analgesic duration and reduce the systemic analgesic consumption and its side effects. Various adjuvants such as opioids, clonidine, verapamil, neostigmine and tramadol have been tried to prolong peri-operative analgesia. Although role of dexamethasone as an adjuvant is debated over a long period, it's still being used widely.¹³ The objective of this study was to compare effect of dexamethasone as an adjuvant to local anaesthetic agents versus local anaesthetics only on onset of sensory and motor blockade in supraclavicular brachial plexus block.

Supraclavicular brachial plexus block is a commonly practiced peripheral nerve block for upper limb surgeries for operative anaesthesia as well as for postoperative analgesia. Local anaesthetics used alone for the block provide good operative conditions but onset of action is remarkably slow. Glucocorticoids have strong anti-inflammatory action and it has been shown to shorten the onset of the nerve block. Dexamethasone is a cost effective and easily available non-particulate steroid which has antiemetic, anti-inflammatory and analgesic properties^[13, 14]. Hence, dexamethasone was selected for the study of its effect on onset of sensory and motor blockade in supraclavicular brachial plexus block.

In this study, it was found that addition of dexamethasone to local anaesthetics significantly shortened onset of sensory and motor blockade as compared to local anaesthetics only. The findings were in concurrence with the study conducted by Islam, S. et al.^[15]. They used plain 2% lignocaine in the local anaesthetic mixture instead of lignocaine with adrenaline unlike this study even though total volume of local

anaesthetics was 35 ml as against 30 ml used in this study. The mean onset time of sensory blockade in their study was 11.64 ± 2.19 minutes in control Group and 9.89 ± 1.97 minutes in study Group. The mean onset time of motor blockade in their study was 13.32 ± 0.96 minutes in control Group and 11.09 ± 26 minutes in study Group. Enhanced effect of dexamethasone on hastening onset of sensory and motor blockade in our study was probably due to incorporation of lignocaine with adrenaline instead of lignocaine 2% (plain) in the local anaesthetic mixture [16].

The result of this study was similar to the result obtained by A. J. Metei et al. [17] who used same dose of dexamethasone in their study. The mean onset time of sensory blockade in their study was 12.55 ± 4.52 minutes in control Group and 9.52 ± 4.01 minutes in study Group. The onset of sensory blockade in their study was marginally delayed probably due to use of peripheral nerve stimulator instead of ultrasound guidance unlike our study.

The early onset of sensory and motor blockade may be due to synergistic effect of dexamethasone with local anaesthetics. No untoward side effect of dexamethasone was observed in this study.

Conclusion

Dexamethasone when added to local anaesthetic agents in supraclavicular brachial plexus block significantly shortens the onset of sensory and motor blockade without any untoward side effect.

Conflicts of interest

Nil.

Acknowledgement

Nil.

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