

Effectiveness of Dexamethasone as an Adjuvant to Local Anesthetic Mixture in Supraclavicular Brachial Plexus Block

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Abstract

Adjuvant drugs are used to prolong the analgesic effects of local anesthetics in regional nerve blocks. This study was done to show the efficacy of Dexamethasone as a potent adjuvant in Supraclavicular Brachial plexus block. 60 patients who underwent upper limb surgeries were chosen for supra clavicular brachial plexus block and randomly allocated to two equal groups, one to receive Dexamethasone and the other to receive normal saline along with Lignocaine Bupivacaine mixture. Time of onset and duration of motor and sensory blockade were noted. The quality of Anesthesia and occurrence of complications was also observed. The mean onset time of sensory blockade in group A is 19.30, and in group B is 16.43 minutes. ($p<0.005$). The mean onset time of motor blockade in group A is 15.13 minutes, in group B is 13.33 minutes ($p<0.005$). In group A the quality of Anesthesia is 3 for 26 patients, 2 for 4 patients and in group B it is 3 for 29 patients and 2 for 1 patient. Statistical analysis shows the p value is 0.161, which is not significant. The mean duration of motor blockade in group A is 207.67 minutes, in group B is 374.93 minutes ($p<0.005$). The mean duration of sensory blockade in group A is 318.77 minutes, in group B is 642.33 minutes ($p<0.005$). There were no complications reported. We conclude that addition of dexamethasone to local anesthetic mixture fastens the onset of action of motor and sensory blockade, and prolongs the duration of motor blockade and analgesia significantly.

Keywords: Adjuvant; Dexamethasone; Local Anesthetic; Supra Clavicular Block.

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Introduction

The International Association for the Study of pain has defined pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage. The relief of pain during surgery is the main part of Anaesthesia. In 1784 James Moore used mechanistic concepts to promote neural compression as a useful technique for the provision of surgical anaesthesia [1]. In 1860 Albert Niemann was successful in isolating and naming the alkaloid, cocaine from the leaves of erythroxylon coca which

was the first local anesthetic [2]. Brachial plexus block is a popular and widely employed regional nerve block technique for perioperative Anesthesia and Analgesia for surgery of the upper extremity. Regional nerve block avoids the unwanted effect of the anesthetic drugs used during General Anesthesia and the stress of laryngoscopy and tracheal intubation.

The supraclavicular approach is the method of choice for blocking the brachial plexus. William Steward Halsted first performed brachial plexus block in 1895 [3]. In 1911 Kulenkampff and Hirshel

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described the first percutaneous brachial plexus block by supraclavicular and axillary routes respectively [4]. Of the various techniques, the most widely practiced methods are the Classical technique described by Patrick, Vertical plumb pop technique described by Brown, 1st rib Walk over technique described by Bonica and Moore, and the subclavian perivascular technique described by Winne and Colins. Lignocaine and bupivacaine are used more frequently for brachial plexus block in our hospital. Adrenaline is added to the local anesthetics to prolong the duration of action and to minimize the systemic absorption. To extend the duration of analgesia various drugs like clonidine, ketamine and opiods have been studied as adjuvants to the local anesthetic solution [5]. These adjuvant drugs are ideally expected to prolong the analgesic effects without causing any systemic side effects or prolonging motor blockade. One such effective adjuvant is Dexamethasone.

Aims and Objectives

The aim of the study was to evaluate the following observations in patients receiving either dexamethasone or the placebo as an adjuvant to local anesthetic mixture in supraclavicular brachial plexus block.

- Onset of sensory blockade.
- Onset of motor blockade.
- Quality of Anesthesia.
- Duration of sensory blockade.
- Duration of motor blockade.
- Hemodynamic changes.
- Complications.

Materials and Methods

This study was a prospective randomized comparative study. After receiving the Institutional ethical committee approval and informed consent from the patients they were randomly allocated into two groups.

A total number of 60 adult patients of both sexes in the age group of 20 to 60 years belonging to ASA I / II category who were posted for various type of upper limb surgeries in the department of Orthopaedics at Govt. Rajiv Gandhi hospital, Chennai formed the study group. Patients of ASA III / IV with coagulopathies, diabetes, acid peptic disease and allergy to local anesthetics were excluded.

Groups

Group A: 30 patients received 15 ml 2% lignocaine with

15 ml 0.5% bupivacaine with 2 ml of 0.9% normal saline.

Group B: 30 patients received 15 ml 2% lignocaine with

15 ml 0.5% bupivacaine with 8 mg dexamethasone.

Subclavian perivascular technique was used to perform brachial plexus block.

Evaluation of Motor Blockade

Motor block is evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve) and flexion of the elbow in supination and pronation of the fore arm (musculocutaneous nerve) for every one minute.

Evaluation of Sensory Blockade

Sensory blockade is evaluated by pinprick in the area of the above four nerves for every 1 minute. The Hollmen's scale is used in the study for assessing both sensory and motor blockade.

Evaluation was carried for every minute after completion of the injection and the time of onset was noted for both sensory and motor blockade. Only patients with complete motor and sensory blockade were included in the study. Once block was complete, surgery was allowed to proceed. Duration of sensory blockade was considered as the time interval between the complete sensory blockade and the onset of regression of sensory blockade - first pain to pin prick (VAS 3). Duration of motor blockade was considered as the time interval between the complete motor blockade and onset of regression of motor blockade. In the postoperative period the regression of motor and sensory blockade was tested for every 30 minutes.

Monitoring during anesthesia focuses on systemic toxicity of local anesthetic, complications of block like pneumothorax and Horner's syndrome. Parameters like heart rate, systolic BP, diastolic BP, MAP, SpO₂, ECG are monitored throughout the surgery and in the postoperative period upto the onset of regression of motor and sensory blockade. In the postoperative period pain was assessed using a numerical rating pain score scale (visual analogue scale) where 0 represents no pain, 10 represents the worst possible pain.

Statistical Analysis

Results were expressed as mean and standard deviation. All statistical analysis were carried out using SPSS for window version 15.0. The t-test was used for comparison of quantitative variants. Qualitative variants were compared using the chi-square test. A 'p value' of less than 0.05 was considered statistically significant.

Observation and Results

The mean age of patients in group A is 37.73 years and in group B is 34.93 years, the p value is 0.386, the difference is not statistically significant. Both groups are comparable in terms of age. The percentage of male patients in group A is 83.3% and in group B is 80.0%, the percentage of female patients in group A is 16.7% and in group B is 20.0%, p value is 0.739, it is not statistically significant. Both groups are comparable in terms of sex. The mean BMI of group A is 24.97 and group B is 24.60, the p value is 0.288, it is not statistically significant. Both groups are comparable in terms of BMI. In group A, 83.3% patients were ASA I and 16.7% were ASA II patients.

In group B 86.6% patients were in ASA I and 13.3% were ASA II patients. The data is statistically not significant ($p>0.05$) and both the groups are comparable in terms of ASA PS Status.

The mean onset time of motor blockade in group A is 15.13 minutes, in group B is 13.33 minutes. Statistical analysis reveal p value < 0.005 , it is statistically significant (Table 1).

The mean onset time of sensory blockade in group A is 19.30, and in group B is 16.43 minutes. Statistical analysis reveal p value < 0.005 , which is statistically significant (Table 2).

In group A the quality of anesthesia is 3 for 26 patients, 2 for 4 patients and in group B it is 3 for 29 patients and 2 for 1 patient. Statistical analysis shows the p value is 0.161, which is not significant (Table 3).

The mean duration of surgery in group A is 152.47 minutes, and in group B is 153.40 minutes. Statistical analysis show the p value is 0.690. The p value is not statistically significant.

The mean duration of motor blockade in group A is 207.67 minutes, in group B is 374.93 minutes. Statistical analysis show the p value < 0.005 , which is statistically significant (Table 4).

The mean duration of sensory blockade in group A is 318.77 minutes, in group B is 642.33 minutes.

Statistical analysis show the p value is <0.005 , which is statistically significant (Table 5).

The heart rate is measured pre block and 1 min, 5mins, 10mins, 15mins, 30mins, 45mins after the block and at the end of the surgery. Statistical analysis using student t test shows the p value of 0.599, 0.504, 0.561, 0.386, 0.176, 0.195, 0.205, and 0.935 respectively, which are not significant.

The systolic blood pressure is measured during pre block, 1min, 5mins, 10mins, 15mins, 30mins, and 45mins after the block and at the end of the surgery. Statistical analysis using student t test shows the p value of 0.435, 0.480, 0.694, 0.475, 0.313, 0.367, 0.561, and 0.895 respectively, which is not significant. The diastolic blood pressure and mean arterial pressure are measured during pre block, 1min, 5mins, 10mins, 15mins, 30mins, 45mins, after the block, and at the end of the surgery. The p values are calculated using student t test. The p values are statistically not significant.

In group A 10% patients complained of nausea, 90% patients were nausea free, in group B 3.3% patients complained of nausea, and 96.6% patients were free of nausea. Statistical analysis shows the p value of 0.301, which is statistically not significant.

Table 1: Onset of motor blockade

Group	No	Mean	SD	P value
A	30	15.13	0.860	<0.005
B	30	13.33	0.884	SIG

Table 2: Onset of sensory blockade

Group	No	Mean	SD	P value
A	30	19.30	0.915	<0.005
B	30	16.43	0.774	SIG

Table 3: Quality of Anesthesia

Group	Quality			P value	
	1	2	3		
No	%	No	%	No	%
Group A	_	4	13.3	26	86.7
Group B	_	1	3.3	29	96.7
					N.S

Table 4: Duration of motor blockade

Group	No	Mean	SD	P value
A	30	207.67	16.219	< 0.005
B	30	374.93	13.829	SIG

Table 5: Duration of sensory blockade

Group	No	Mean	SD	P value
A	30	318.77	20.997	<0.005
B	30	642.33	30.250	SIG

Discussion

Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries. A combination of Lignocaine and Bupivacaine provided better operating conditions but the duration of analgesia is rarely maintained for more than 4-6 hours. Addition of steroid to local anaesthetics effectively and significantly prolongs the duration of analgesia as well as producing earlier onset of action [6]. Steroids are very potent anti-inflammatory and immunosuppressive agents. Perineural injection of steroid is reported to influence postoperative analgesia. Epidural steroids were used for treatment of back pain and sciatica. Various steroids has been used for this purpose, but Dexamethasone, a 9 alpha derivative synthetic glucocorticoid is preferred because of its highly potent anti-inflammatory property, about 25-30 times as potent as hydrocortisone and without any mineralocorticoid activity. It was found to be safer and devoid of potential side effects.

Pre-operative administration of dexamethasone by oral and intravenous routes has been shown to reduce overall pain scores and analgesic requirements in the postoperative period without any adverse effects in various dental and general surgical procedures [7]. Dexamethasone is also known to reduce post-operative nausea and vomiting. The possible mechanism of analgesic and antiemetic actions are due to anti-inflammatory property of Dexamethasone [8]. It has been also observed that addition of small amount of Dexamethasone to local anesthetics prolonged the duration of analgesia after subcutaneous, intercostal block, intra articular, and epidural [9].

Our finding is comparable with the study conducted by Shrestha B. R et al. in 40 patients. They found that complete sensory blockade in dexamethasone group occurs in mean 16.76mins, and complete motor blockade occurs in mean 12.90 minutes. The early onset of action might be due to synergistic action of Dexamethasone with local anaesthetics on blockage of nerve fibres [10].

In our study motor blockade occurs earlier than sensory blockade, this finding is comparable with

the study conducted by Winnie in 1977, he described the outer motor fibers are blocked earlier than the sensory fibers which are situated deeper in the plexus at the level of trunk and division [11]. In our study regression of motor blockade occurs earlier than sensory regression, this finding is comparable with the study conducted by De Jong et al. [12]. The duration of pain relief (postoperative analgesia) was markedly prolonged (mean 642.63 minutes) in Dexamethasone group, while it was only 318.77 minutes in control group. These results are similar to findings of study of Yadav et al. [13].

Probable mechanism of action of Dexamethasone in prolonging the sensory blockade was postulated by number of studies. It was found that the steroids have the nociceptive Cfibres blocking quality [14]. It was suggested that the steroids alter k⁺ channel, thereby have synergistic action with local anaesthetics in nerve fibres [15]. The vasoconstricting property of steroids is attributed to the analgesia prolonging action similar to the action of adrenaline when added with local anaesthetics [16]. Other possibilities are action on corticosteroid receptor in brain after being absorbed from periphery to systemic circulation [18] and suppression of ectopic neuronal discharge [19]. Dexamethasone is not shown to be associated with any neurological complications [20].

Conclusion

From our study we conclude that addition of Dexamethasone to local anesthetic mixture fastens the onset of action of motor and sensory blockade, and prolongs the duration of motor blockade and analgesia significantly. It may be useful in situations where epinephrine is contraindicated as in hypertension and ischemic heart disease.

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