



Original Research Article

Supraclavicular brachial plexus block with and without dexamethasone as an adjuvant to local anesthetics - An observational study

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ABSTRACT

Background: Brachial plexus block with bupivacaine provides very effective intraoperative anaesthesia and also analgesia. It was found that when dexamethasone was added as an additive to bupivacaine, it increases the duration of anaesthesia and also the duration of analgesia. This study was carried out to compare onset and duration of sensory and motor blockade and duration of postoperative analgesia on addition of dexamethasone to local anesthetic and local anesthetic alone in supraclavicular brachial plexus block.

Materials and Methods: After obtaining the approval from the Institutional Ethical committee and written informed consent from the patients, 60 patients were included in our study.

We included 60 ASA I & II patients who were aged between 18 years & 60 years, underwent elective upper limb surgeries. They were divided into two equal groups.

Group 1 (cases) who received 15 milliliter of 2% lignocaine with adrenaline and 15 milliliter of 0.5% bupivacaine + dexamethasone 8mg(2ml).

Group 2 (controls) who received 15 milliliter of 2% lignocaine with adrenaline and 15 milliliter of 0.5% bupivacaine + 0.9% normal saline(2ml).

We observed the Onset of sensory and motor blockade, duration of sensory and motor blockade and postoperative analgesia between the two groups.

Results: The onset of sensory blockade was within 7.3 min in group 1. In group 2 the onset of sensory blockade was 13.66 minutes.

The onset of motor blockade was within 3.93 min in group 1. In group 2 the onset of motor blockade was 18.66 min.

The duration of intra operative analgesia was 654.33 minutes in group 1. In group 2 the duration of intra operative analgesia was 292.6 minutes.

The duration of post operative analgesia was 815±13.57 minutes in group 1. The duration of post operative analgesia in group 2 was 393.8±42.88 minutes.

There were no complications in both the groups in intra operative period and post operative period.

Conclusion: Dexamethasone, when added to 15 millilitre of 0.5% bupivacaine and 15 millilitre of 2% lignocaine plus adrenaline, very effectively enhances the onset of sensory and motor blockade. It dramatically prolongs the duration of sensory and motor blockade and duration of analgesia. There were no untoward side effects with the use of dexamethasone as an additive in the brachial plexus block.

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1. Introduction

Peripheral nerve blocks can be used for anesthesia, postoperative analgesia, diagnosis and treatment of chronic pain disorders. Skilful application of peripheral nerve

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blockade broadens the anesthesia provider's range of options in providing optimal anesthetic care. These techniques can be used in all age groups, with appropriate selection and sedation.¹

Peripheral nerve blocks are safer than general and spinal anesthesia with distinct advantage. Peripheral nerve blocks provide very good intra operative anesthesia. It also extends the analgesia in the postoperative period without any untoward systemic side effects.² They also provide extended postoperative analgesia with minimal side effects. In addition, it offers a better preservation of mental functions in elderly; decreased risk of aspiration due to intact pharyngeal and laryngeal reflexes; avoids difficult intubation; decreases postoperative complications associated with intubation and provides better postoperative analgesia without undue sedation facilitating early mobilization and discharge.³

Brachial plexus blocks are among the most commonly studied peripheral nerve blocks because of their high success rate and their ability to provide prolonged postoperative analgesia. In addition, the sympathetic block produced is of value for arm or hand re-implantation surgery or to establish a vascular shunt for dialysis.⁴ Successful block of the brachial plexus relies on the fact that these branches are enveloped in a tubular sheath of fascia. Thus if one branch is identified by eliciting paraesthesia or by using a nerve stimulator and a reasonably large volume of anesthetic injected, blockade of the entire plexus may be predicted.⁴

The supraclavicular approach is the most common approach to brachial plexus block. The brachial plexus is arranged in a very compact space as the plexus crosses the first rib. Thus inclusion of all three trunks in the block may be predicted.

Unfavorable factors of brachial plexus block are the time required for onset of action and duration of analgesia. Increasing the dose or volume of local anesthetics increases the risk of systemic toxicity and continuous catheter block techniques requires additional time, cost and skill. "Hence, there has always been a search for adjuvant to the regional block with drugs that prolongs the duration of analgesia with lesser adverse effects". Recently, dexamethasone has been studied as an adjuvant to local anesthetic in peripheral nerve block.^{5,6} Steroids prolong the duration of nerve block. They produce analgesia by blocking transmission of nociceptive myelinated c-fibers and they suppress the ectopic neuronal discharge.

We preferred to use dexamethasone in our study as it is said to prolong the duration of anesthesia and analgesia. It is also found that dexamethasone is safe without any untoward side effects and also protects from the bupivacaine induced neurotoxicity.⁷ The analgesic property of corticosteroid is the result of local action and not the systemic absorption.⁸ Thus, dexamethasone which is a

non-particulate steroid, is easily available, cost effective, antiemetic, anti-inflammatory, analgesic, non-neurotoxic drug was selected as an additive to local anesthetics to observe the effects of it on various characteristics of supraclavicular brachial plexus block.

2. Aims and Objectives

2.1. Primary objective

To observe the effect of addition of dexamethasone to local anesthetic in brachial plexus block on the duration of intra operative analgesia, the duration of motor blockade and duration of post operative analgesia

2.2. Secondary objective

To observe the effect of addition of dexamethasone to local anesthetic in brachial plexus block on

1. The onset of sensory block in minutes
2. The onset of motor blockage in minutes
3. side effects/complications if any

3. Materials and Methods

We obtained the approval of the Institutional Ethical committee. Written and informed consent was taken from the patients in their vernacular language. Sixty patients were included in our study.

3.1. Inclusion criteria

The patients fulfilling the following criteria were included in our study

1. Age group from 18-70 years
2. American Society of Anesthesiology Grade 1 and 2
3. Upper limb surgeries below the shoulder joint (both elective and emergency)

3.2. Exclusion criteria

The patients having following criteria were not included in our study.

1. Consent not given for the block
2. American Society of Anesthesiology grade 3 and grade 4
3. Any history of bleeding disorders.s
4. Patients on anticoagulant medications
5. Severe respiratory distress
6. Neuro deficit involving brachial plexus
7. Patients having history of allergy to local anesthetic drugs
8. Local infection at site where block was to be given
9. Patients with history of peptic ulcer disease, diabetes mellitus, hepatic or renal failure (as they are contraindications to the use of steroid)

After approval of institutional ethical committee, written and informed consent was taken from the patients in their vernacular language. Sixty patients were included in our study according to our inclusion criteria. A preanesthetic checkup was done for all patients which included a detailed history, general physical and systemic examination. Basic investigations were done (Haemoglobin %, complete blood counts, bleeding time, clotting time, random blood sugar, serum urea, serum creatinine, if age above 45yrs then ECG). Patients were kept nil per oral overnight. Since randomization cannot be done from the beginning of the study patients were selected alternatively. Supraclavicular block is one of the commonest technique in brachial plexus block. It is performed at the level of trunks where sensory, motor and sympathetic innervation of upper limb lies in small surface area.

The time from injection of local anesthetic to onset of analgesia in each of the major peripheral nerve distributions i.e ulnar nerve, medial nerve, radial nerve and musculocutaneous nerve was considered as The Onset of sensory block.

The onset of Sensory block was assessed using pinprick using blunt end of a 27 gauge needle at duration of 0, 2, 5, 10, 15, 20, and 30 minutes.

“Sensory block was assessed by pinprick test using 3-point scale:

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

The time of injection of local anesthetic to the inability of the patient to move his/her finger or raise hand was considered as The Onset of motor block.

The onset of Motor block was measured at 0, 10 and 20 minutes by assessing the following motor functions: flexion at the elbow i.e musculocutaneous nerve, extension at elbow and wrist i.e radial nerve, opposition of thumb and index finger i.e median nerve, and opposition of thumb and small finger i.e ulnar nerve.

“Motor blockade was assessed using modified Bromage three point score:

1. Indicates Normal sensation
2. Indicates Decrease in motor strength with the ability to move fingers only
3. Indicates Complete motor block with the inability to move fingers”

3.3. Duration of analgesia

During the procedure anesthesia was considered as satisfactory or adequate if the patient did not complain of pain or discomfort or if no sedation was required. Post operative monitoring was carried out in the recovery room and the postoperative ward. The duration of analgesia was

noted according to “visual analogue scale for pain” at every half an hour for the first ten hours and then hourly for the next 24 hours. When the patient complained of worst pain (Visual Analogue Score of 8-10), it was considered that the analgesic action of the drug has been terminated. The rescue analgesic (I.M Diclofenac 1-1.5mg/kg) was given to the patient.

The duration of motor block was assessed every hour postoperatively. Patients were asked to move their fingers and to raise their hands to check for the return of motor activity. This time was recorded and was considered as the cessation of motor block.

3.4. Statistical analysis

Data was analysed using Microsoft excel sheet and SPSS 22 version software. Frequencies and proportions were used to represent categorical data. Chi-square was used as test of significance. Mean and standard deviation were used to represent continuous data. Independent t test was used as test of significance. Paired t test is the test of significance for paired data such as before and after drug. p value of <0.05 was considered as statistically significant..

4. Results

4.1. Demographic data

In this study, Table 1 shows distribution of patients according to their age and weight. 37.26 ± 15.55 years was mean age in group 1 and in group 2 it was 36.56 ± 16.86 with p value being 0.8678. 58.466 ± 3.9642 kg was the mean weight in group 1 and in group 2 it was 60.4 ± 4.95 kg with p value of 0.1002. So both the groups were comparable in terms of age and weight.

In this study out of 60 patients, group1 consisted of 70% males whereas there were 60% in group 2 and group 1 consisted of 30% of females and 40% in group2, hence males outnumbered females in both the groups.

The mean duration of surgery in group 1 was 50 ± 19.95 minutes and in group 2 was 46.6 ± 15.55 minutes with p value of 0.4646. There was no statistical difference between both the groups.

4.2. Preoperative monitoring

In this study, the average pulse rate was found to be 82 ± 7.393 beats per minute in group 1 i.e in cases. In group 2 i.e controls mean pulse rate was 84.27 ± 6.57 beats per minute (p value: 0.2138).

The mean systolic BP was found to be 126.3 ± 7.967 mm of Hg in group 1. In controls i.e group 2 mean systolic BP was 123.4 ± 8.63 mm of Hg (p value 0.1815).

The mean diastolic BP was found to be 76.60 ± 5.150 mm of Hg in group 1 and 74.87 ± 6.33 mm of Hg in group 2 (p value 0.2503).

The mean oxygen saturation in group 1 was found to be 98.17±0.3790% and in group 2 it was found to be 98.13±0.34% (p value 0.6686).

There was no significant difference between both the groups in terms of pulse rate, systolic and diastolic BP and oxygen saturation preoperatively. Both the groups were comparable.

In our study, the onset of motor blockade was sooner in group 1 i.e cases with mean onset time of 3.93±0.96 minutes. The mean onset of motor blockade in group 2 i.e controls was 18.66±2.05 minutes. The data was found to be statistically significant (p value <0.0001).

The onset of sensory blockade in group 1 was also sooner with mean onset time of 7.3±1.69 minutes. The mean onset of sensory blockade was found to be 13.66±1.76 minutes in group 2. The data was statistically significant (p value <0.0001).

In this study the duration of motor blockade was prolonged in group 1. The mean duration was 654.33±82.48 minutes in group 1 and 292.6±56.25 minutes in group 2. This data was statistically significant with p value <0.0001.

The duration of sensory blockade was observed to be longer in group 1 with mean duration of 772±12.8 minutes and 361±42.1minutes in group 2. This data was statistically significant (p value <0.0001).

The mean duration of analgesia was 815±13.57 minutes in group 1 whereas in group 2 it was 393.8±42.88 minutes. The values were statistically significant. The duration of surgery between both the groups was not found to be statistically significant.

It was observed that in group 1 only 1 patient had VAS score of 8 by 12 hours whereas 29 patients had VAS score more than 8 by about 16 hours. However in group 2 all patients had VAS score of more than 8 by 8 hours.

Table 1: Distribution of patients according to age and weight

	Group 1	Group 2	p value
Age (in yrs)	37.26±15.55	36.56±16.86	0.8678
Weight (in kg)	58.466±3.9642	60.4±4.95	0.1002

Table 2: Distribution of subjects according to sex

Sex	Group 1(cases)	Group 2(controls)
Male	21(70%)	18(60%)
Female	9(30%)	12(40%)
Total	30(100%)	30(100%)

5. Discussion

Supraclavicular brachial plexus block is a popular and widely employed regional nerve block technique for perioperative anaesthesia and analgesia for surgery of the upper extremity. Brachial plexus block prevents the

Table 3: Preoperative monitoring of pulse rate, systolic BP, diastolic BP and saturation between the two groups

	Group 1(cases)	Group 2(controls)	P value
Pulse Rate	82±7.393	84.27±6.57	0.2138
SBP	126.3±7.967	123.4±8.63	0.1815
DBP	76.60±5.150	74.87±6.33	0.2503
SPO2	98.17±0.3790	98.13±0.34	0.6686

Table 4: Comparison of cases and controls with respect to onset of motor and sensory block

	Group 1(cases)	Group 2(controls)	p value
Onset of motor block (min)	3.93±0.96	18.66±2.05	p < 0.0001
Onset of sensory block (min)	7.3±1.69	13.66±1.76	p < 0.0001

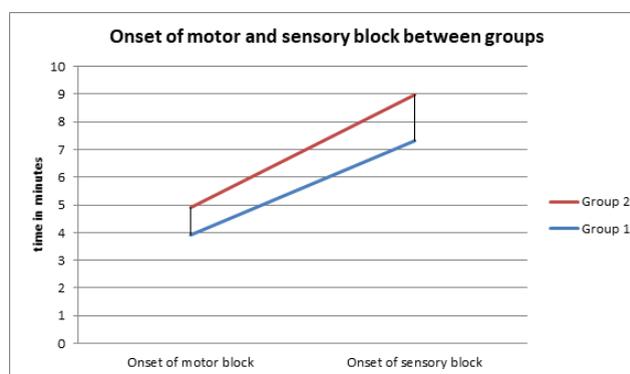


Fig. 1: Line diagram- onset of sensory and motor block between the two groups

Table 5: Duration of surgery, sensory block and motor block and duration of analgesia between the two groups

	Group 1(cases)	Group 2(controls)	p value
Duration of surgery in minutes	50±19.95	46.6±15.55	0.4646
Duration of motor block in minutes	654.33±82.48	292.6±56.25	<0.0001
Duration of sensory block in minutes	772±12.8	361±42.1	<0.0001
Duration of analgesia in minutes	815±13.57	393.8±42.88	<0.0001

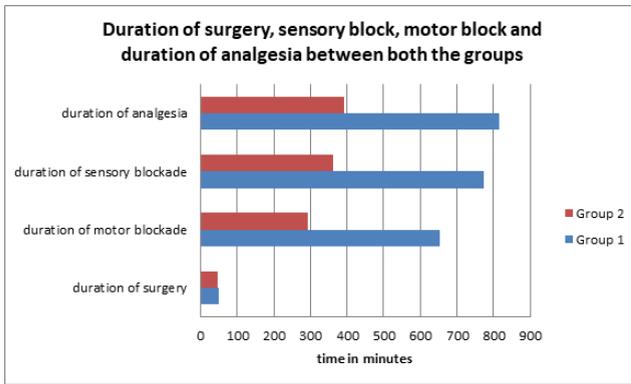


Fig. 2: Bar diagram indicating duration of surgery, sensory block and motor block and duration of analgesia between the two groups

Table 6: Visual analogue scale- score between the two groups

Vas score	Group 1		Group 2	
	<8	> 8	< 8	>8
30 min	30	0	30	0
60 min	30	0	30	0
90 min	30	0	30	0
2 hrs	30	0	30	0
3 hrs	30	0	30	0
4 hrs	30	0	30	0
8 hrs	30	0	0	30
12 hrs	29	1	0	0
16 hrs	0	30	0	0
20 hrs				
24 hrs				

untoward complications of general anaesthesia. Local anaesthetics used alone for supraclavicular brachial plexus block provide good operative conditions but they have shorter duration of postoperative analgesia. A combination of bupivacaine and lignocaine provides good operating conditions but the duration of analgesia and motor blockade may be short. So various drugs like fentanyl, clonidine, neostigmine, Midazolam, buprenorphine, dexmedetomidine and butorphanol were used as adjuvant with local anaesthetics in brachial plexus block so as to achieve quick, dense and prolonged block. But the results are either inconclusive or they are associated with side effects. Glucocorticoids have powerful anti-inflammatory action and it has been shown that they prolong the duration of analgesia.

We have selected supraclavicular approach of brachial plexus block. Supraclavicular brachial plexus block is widely employed regional nerve block to provide anaesthesia and analgesia for the upper extremity surgery. It provides a rapid, dense and predictable anaesthesia of the entire upper extremity. It is the most effective block for all the portions of the upper extremity and is carried out at the “division” level of the brachial plexus.

We used lignocaine with Adrenaline as it provides early onset of action and bupivacaine is known for longer duration of action. We preferred to use dexamethasone in our study as it is found to prolong the duration of anaesthesia and analgesia. Dexamethasone, a non-particulate steroid which is easily available, cost effective, antiemetic, anti-inflammatory, analgesic and non-neurotoxic drug was selected as an adjuvant to local anaesthetics to examine the effects of it on various characteristics of supraclavicular brachial plexus block.

In our study we found that the addition of dexamethasone to local anaesthetic causes early onset of sensory and motor blockade. These findings concurred with study conducted by Islam S M,⁹ Siddharth et al¹⁰ who used similar amount of 0.5% bupivacaine and 2% lignocaine with dexamethasone. However studies done by Shaikh M R¹¹ and Arish BT,¹² didn't find significant difference in onset of sensory and motor blockade between the two groups. The early onset of sensory and motor blockade by the addition of dexamethasone may be because of the synergistic action of dexamethasone with local anaesthetics.

Further in our study we found that the addition of dexamethasone prolonged duration of motor and sensory blockade (654.33±82.48 minutes and 772±12.8 minutes respectively). Several studies conducted by Biradar,¹³ E Devander,¹⁴ Dhumane,¹⁵ Vaibhav Yadav¹⁶ also agreed with this finding. The block prolonging effect may be due to its local action of nerve fibers and not a systemic one.¹⁷ Steroids might exert this effect by altering the function of potassium channels in the excitable cells; bind to intracellular receptors and modulate nuclear transcription.^{13,18}

The disadvantage of the prolonged duration of motor blockade is the chances of trauma in the postoperative period and difficulty in assessing the neurotoxicity caused by the drug or neuro deficit caused by nerve injuries during surgery.

The addition of dexamethasone also resulted in prolonged postoperative analgesia and reduced need for rescue anaesthesia. The results were quantified by VAS score.

The results accorded with studies done by Metei AJ et al.¹⁹ who used 4mg of dexamethasone versus 8mg of dexamethasone in our study. However similar results were obtained.

Sandhya Agarwal et al²⁰ in their study they compared the effects of adding dexmedetomidine to bupivacaine in supraclavicular brachial plexus block. The result was similar to our study but the onset of sensory blockade was even faster in our study may be because of dexamethasone + 2% lignocaine with adrenaline along with bupivacaine. They found that one patient had bradycardia with the use of dexmedetomidine however there was no untoward side effect in our study with the use of dexamethasone.

6. Complications

Patients were monitored intra operatively and post operatively up to 24 hrs for haemodynamic changes, nausea, vomiting, Pneumothorax, hemothorax, horner's syndrome and phrenic nerve block. In our study there was no significant change in pulse rate, systolic BP, diastolic BP and saturation intra operatively as well as postoperatively. (p value >0.05). No other block related complications like pneumothorax, hemothorax, horner's syndrome or phrenic nerve palsy were seen. In this study no patients developed neurotoxicity.

Complications like the incidence of Horner's syndrome,⁹ dyspnoea⁹ the incidence of persistent nerve palsy up to 2 weeks and 6 months after Brachial Plexus Block²¹ was observed in other studies. Incidence of Horner's syndrome was reported upto 42% in study conducted by Shaikh M R.¹¹

The safety of use of dexamethasone as an additive in a nerve sheath may raise some concerns. Reports of corticosteroid mediated neurotoxicity may be related to the vehicle polyethylene glycol and the preservative benzyl alcohol in steroid preparations and also the presence of insoluble steroid particulate matter in the IV preparations.²² Dexamethasone sodium phosphate is a non particulate steroid. It does not contain either polyethylene glycol or benzyl alcohol.²² In vivo and in vitro animal studies have demonstrated that locally applied corticosteroid have no long term effect on the structure, electrical properties, or function of the peripheral nerves.²³ The extra fascicular and intra fascicular injection of dexamethasone in a rat sciatic nerve experimental model caused no or minimal peripheral nerve damage.²⁴

7. Limitations of our Study

1. We did not use ultrasound guided nerve block because of unavailability in our institution.
2. We did not study the impact of dexamethasone on glucose homeostasis on wound healing.
3. Sedation score was not been assessed in our study. Dexamethasone doesn't cause sedation, so sedation score may be zero with the use of dexamethasone. This will be helpful in high risk patients where sedation is not required.
4. Sample size used in our study is smaller to access neurotoxicity
5. Follow up was not done up to longer duration to evaluate for dexamethasone induced delayed neurotoxicity if any.

8. Source of Funding

None.

9. Conflict of Interest

The authors declare that there is no conflict of interest

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