International Journal of Medicine Research
ISSN: 2455-7404
www.medicinesjournal.com
Volume 3; Issue 2; April 2018; Page No. 70-74

Effect of addition of dexamethasone to local anaesthetic agent in supra clavicular brachial plexus block: A comparative study

Dr. Monika Gandhi[1*], Dr. KK Arora[2], Dr. Neha Panwar[3], Dr. Manoj Gupta[4]

[1] Associate Professor, Department of Anaesthesiology, M.G.M. Medical College and M.Y. Hospital, Indore, Madhya Pradesh, India
[2] Professor and Head, Department of Anaesthesiology, M.G.M. Medical College and M.Y. Hospital, Indore, Madhya Pradesh, India
[3] Junior Resident, Department of Anaesthesiology, M.G.M. Medical College and M.Y. Hospital, Indore, Madhya Pradesh, India
[4] Ex Resident, Department of Anaesthesiology, M.G.M. Medical College and M.Y. Hospital, Indore, Madhya Pradesh, India

Abstract

Aims and Objectives: The present study entitled "Effect of addition of Dexamethasone to Local Anaesthetic agent in Supra clavicular Brachial plexus block: A Comparative study" is undertaken with the following aims & objective: i) Onset of action, ii) Onset of sensory blockade, iii) Onset of motor blockade, iv) Motor block regression, v) Duration of analgesia, vi) Untoward side effects

Study Design: A prospective, randomized, comparative study consisting of 30 patients in Group A and 30 patients in Group B

Materials and Methods: 60 patients admitted to M.Y. Hospital attached to Mahatma Gandhi Memorial Medical College, Indore undergoing upper limb surgery lasting more than 90 minute were included in the study. The elective surgical interventions were internal fixation of bones with plates and screws, excision of bone cysts, reconstructive and other surgeries involving upper limb.

The anaesthetic procedure to be carried out was explained. They were informed about development of paresthesia written informed consent was taken. They were educated regarding the visual analogue scale. Basic laboratory investigations were conducted including haemogram, urine analysis and whenever needed chest x-ray, electrocardiogram, blood sugar. Serum creatinine, blood urea.

Method of collection of data: Supraclavicular brachial plexus block was carried out as an elective procedure on the patients undergoing upper limb surgery. Sixty patients were randomly allocated into two groups (group A, n=30 and group B, n=30) in double blind fashion. All drugs solutions were prepared by an anaesthesiologist not involved in administration of anaesthesia, patient care and data collection. Group A (n=30): Received brachial plexus block with 2% lignocaine with adrenaline at the dose of 14 ml and 0.5% bupivacaine 16ml to the solution. Group B (n=30): Received brachial plexus block with 2% lignocaine with adrenaline 14 ml and 0.5% bupivacaine 16ml 2mg/kg along with dexamethasone 4mg into the solution. All the necessary equipments and drugs needed for administration of general anaesthesia and for resuscitation were kept ready in order to manage in case of failed block or toxic reactions occurring during the procedure.

The effects of anaesthetics on the following parameters were observed;

Onset of analgesia: 1) Time of onset for sensory blockade, 2) The duration of sensory blockade, 3) The duration of analgesia, 4) Quality of motor blockade, 5) Tourniquet tolerance, 6) Sequelae & complication

Post operative assessment: Patients would be evaluated post operatively, every hourly for first six hours, second hourly for next twelve hours, for the following parameters -intensity of pain, motor and sensory recovery. Patients were also monitored for the side effects of dexamethasone.

Statistical Analysis Used: Chi-Square and Fisher Exact test has been used to find the homogeneity of sex distribution between the two groups and student t test has been used to find the homogeneity age and weight distribution between the two groups. Student t test (Two tailed) has been used to find significant difference of hemodynamics between the two groups and the study parameters namely, Time of onset, duration of surgery, duration of motor and sensory blockade and duration of analgesia between the two groups. Mann Whitney U test has been used to assess the significant difference of VAS score between the two groups. Chi-Square and Fisher Exact test has been used to find significant difference of incidence of side effects between the two groups. The statistical software used were SPSS. 12.0.1 for windows and statistics.

Results: There was statistical significance in terms of onset, sensory blockade, motor blockade and duration of analgesia between the two groups. However the average duration of analgesia were 5.28±0.58hrs and 16.38.±0.29hrs in groups A and B respectively, showed statistical significance. The group B showed prolonged analgesia produced by addition of dexamethasone to local anaesthetics.

Conclusion: The randomized comparative study of Brachial plexus block with local anaesthetics, with and without Dexamethasone has revealed that postoperative analgesia has been found to be significantly prolonged in the Dexamethasone group and can be used safely.

Keywords: brachial plexus block; dexamethasone; local anaesthetics; analgesia

1. Introduction

Brachial plexus provides the motor innervation and nearly all sensory supply of the upper limb. The plexus is formed 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 (post fixed plexus). The components are designated according to their location as roots, trunks, divisions, cords and branches. Roots after emerging from intervertabral foramina unite to form trunks between scalene muscles. Each trunk divides into anterior and posterior divisions. The divisions in combination form cords which surrounds the axillary artery.

Each peripheral nerve consists of both afferent and efferent axons. A typical nerve consists of several axonal bundles or fascicles. Factors that have an important influences on the local anaesthetics diffusion to the axons include are-

1. The perineurium
2. The presence or absence of myelin
3. The size of the axons

4. The anatomical position of the axon, either in the outer or inner section of the nerve.

Each peripheral nerve axon possesses its own cell membrane called axolemma. Non myelinated nerve fibers such as autonomic postganglionic and nociceptive afferent C fibers are encased in a single Schwann cell sheath. Most large motor and sensory fibers are enclosed in many layers of myelin which consists of plasma membranes of specialized Schwann cells that wrap themselves around the axon during axonal growth. Myelin greatly enhances the speed of conduction by insulating the axolemma from the surrounding conducting salt medium and forcing the action current to flow through the axoplasm of nodes of Ranvier, which are periodic interruptions in the myelin sheath where the action currents are regenerated. The sodium channels that serve impulse generation and propagation are highly concentrated at the nodes of Ranvier of myelinated nerve fibers.

Local anaesthetics block impulses by interfering with the function of sodium channels. The diffusion of deposited local anaesthetic drug molecule near the nerve is a function of tissue binding, removal by the circulation, and local hydrolysis of the amino ester anaesthetics. The net result is the penetration of nerve sheath by the remaining drug molecules. Only about 5% of injected dose actually penetrates into the nerve. Many trials on different adjuvants have been done to enhance the blockade by local anaesthetics.

Aims and Objectives

The present study entitled "Effect of addition of Dexamethasone to Local Anaesthetic agent in Supra clavicular Brachial plexus block: A Comparative study" is undertaken with the following aims & objective.

i) Onset of action
ii) Onset of sensory blockade
iii) Onset of motor blockade
iv) Motor block regression
v) Duration of analgesia
vi) Untoward side effects

Material and Methods

60 patients admitted to M.Y. Hospital attached to Mahatma Gandhi Memorial Medical College, Indore undergoing upper limb surgery lasting more than 90 minute were included in the study. The elective surgical interventions were internal fixation of bones with plates and screws, excision of bone cysts, reconstructive and other surgeries involving upper limb.

Inclusion criteria

- Patients with ASA1 and II physical status the age group of 18 to 60 years
- Male & female of both sex
- Patient height more than 150 cm
- Weight more than 55 kg.

Exclusion criteria

- Patients with age less than 16 and greater than 60 year,
- Patients with coagulopathy or on anti coagulants;
- patients with peripheral neuropathy;
- patients with history of substance abuse, local cutaneous infections;
- pregnant or lactating female patients;
- renal failure,
- hepatic failure,
- patients with allergy to local anaesthetics, dexamethasone
- ASA class III and IV patients,
- uncooperative patients, patient refusing, uncoprative;
- Patchy or inadequate Anaesthesia
- Diabetes / Glucose intolerance
- Peptic disease.
- Patients undergoing emergency surgical procedures.

Preoperative preparation

The study protocol was approved by the hospital ethical committee. All the patients underwent thorough preanaesthetic evaluation on the day prior to surgery. All systems were examined including airway and the surface anatomy where the block was going to be given. The anaesthetic procedure to be carried out was explained. They were informed about development of paresthesia A written informed consent was taken. They were educated regarding the visual analogue scale. All the patients were fasted overnight. All of them received oral Alprazolam and tablet ranitidine 150mg night before the surgery.

Basic laboratory investigations were conducted including haemogram, urine analysis and whenever needed chest x-ray, electrocardiogram, blood sugar. Serum creatinine, blood urea.

Method of collection of data

Supraclavicular brachial plexus block was carried out as an elective procedure on the patients undergoing upper limb surgery. Sixty patients were randomly allocated into two groups (group A, n=30 and group B, n=30) in double blind fashion. All drugs solutions were prepared by an anaesthesiologist not involved in administration of anaesthesia, patient care and data collection.

Group A (n=30)

Received brachial plexus block with 2% lignocaine with adrenaline at the dose of 14 ml and 0.5% bupivacaine 16ml to the solution.

Group B (n=30)

Received brachial plexus block with 2% lignocaine with adrenaline 14 ml and 0.5% bupivacaine 16ml 2mg/kg along with dexamethasone 4mg into the solution.

All the necessary equipments and drugs needed for administration of general anaesthesia and for resuscitation were kept ready in order to manage in case of failed block or toxic reactions occurring during the procedure.

Procedure

Intravenous access was secured with 18 G cannula. The following monitors were connected to the patients in the operating room.

1. Pulse oximeter
2. Non invasive blood pressure monitor
3. Three lead ECG monitoring.

Under aseptic precautions brachial plexus block was performed by Supraclavicular approach (classical / perivascular) with patients placed in supine position. After

antiseptic painting and draping, a skin wheal was raised with local anaesthetics. 24-11/2 G needle was inserted at the point of entry above the midpoint of clavicle in the caudal-posterior-medial (CPM) direction. Paresthesia in the forearm or hand was elicited. After negative aspiration for air or blood appropriate drugs were injected. Group A received 2% lignocaine with adrenaline 14ml and 0.5% bupivacaine 16 ml
Group B received 2% lignocaine with adrenaline 14ml and 0.5% bupivacaine 16 ml with dexamethasone 4 mg A separate 6-8 ml injection of 2% lignocaine plain was made for an intercostobrachial nerve block in the axilla to provide anaesthesia for application of tourniquet.
The effects of anaesthetics on the following parameters were observed;

Onset of analgesia
Recorded by subjective feeling of loss of pain, heaviness, tingling and numbness after deposition of local anaesthetic. Skin was pricked with 25G needle every 3 minute to test sensation. (No pain from pin prick) was recorded.

Time of onset for sensory blockade
Defined as time between injection and total abolition of pinprick response, was evaluated in four nerve areas (radial, ulnar, median and muscuocutaneous) at every 3 minutes until 45 minutes after the injection. The block was judged to be failed if anaesthesia was not present in 2 or more peripheral nerve distribution and such patients were excluded from the study.

The duration of sensory blockade
Defined as the time between onset of action and return of pinprick response, was assessed every 30 minutes in at least 3 major nerve territory.

The duration of analgesia
Defined as the time between the onset of action and the onset of pain, was the time when the patients received the first dose of analgesic. Supplemental analgesia was given in the form of intramuscular inj Diclofenac sodium 75 mg, when visual analogue scale score was more than 4.

Quality of motor blockade
Assessed every 5 minutes for first 30 minute
Grade I: ability to flex & extend the forearm
Grade II: ability to flex & extend wrist &fingers
Grade III: ability to flex only fingers
Grade IV: inability to move forearm, wrist, fingers

Tourniquet tolerance
Assessed by the number of times needle needs to be redirected:-

Easy: plexus reached in first attempt.
Difficult: needle needs to be redirected more than once

Sequelae & complication
A careful watch was kept for complication such as bradycardia, hypotension, vascular punctur, haematoma, headache, convulsion, respiratory depression, pneumothorax, phrenic nerve block and diaphragmatic paralysis.

Post operative assessment
Patients would be evaluated post operatively, every hourly for first six hours, second hourly for next twelve hours, for the following parameters -intensity of pain, motor and sensory recovery. Patients were also monitored for the side effects of dexamethasone. The intensity of pain was assessed using visual analogue scale (vas) score. This scale consists of a 100mm line on which the patients represented the degree of pain he/ she was experiencing by placing a point somewhere between “no pain” (“0”) and the worst pain ever experienced (“100”).

Statistical Analysis Used
Chi-Square and Fisher Exact test has been used to find the homogeneity of sex distribution between the two groups and student t test has been used to find the homogeneity age and weight distribution between the two groups. Student t test (Two tailed) has been used to find significant difference of hemodynamics between the two groups and the study parameters namely, Time of onset, duration of surgery, duration of motor and sensory blockade and duration of analgesia between the two groups. Mann Whitney U test has been used to assess the significant difference of VAS score between the two groups. Chi-Square and Fisher Exact test has been used to find significant difference of incidence of side effects between the two groups. The statistical software used were SPSS. 12.0.1 for windows and statistics.

Results

Table 1: Comparison of Study parameters between two groups

Study Parameter	Group A (n=30)		Group B (n=30)		P Value
	Mean	SD	Mean	SD	
Time of onset (Minutes)	20.13	3.50	15.57	2.31	<0.0001
Onset of sensory blockade (minutes)	6.13	0.86	4.23	0.73	<0.0001
Onset of motor blockade (minutes)	9.70	1.32	7.57	1.07	<0.0001
Motor block regression (minute)	148	20.74	426	71.08	<0.0001
Duration of analgesia (hours)	5.28	0.5813	16.38	0.2901	<0.0001

Table 2: Comparison of side effects between the two groups

Side Effects	Group A (n=30)	Group B (n=30)
Nausea	3 (10.0%)	3 (10.0%)
Vomiting	2 (6.7%)	1 (3.3%)
Numbness	1 (3.3%)	1 (3.3%)
No side effects	24 (80.0%)	25 (83.3%)

Discussion

In our study we observed that there was change in the time of onset of action and duration of analgesia between two groups. The pH of the injected solution around the nerve would certainly influence the onset of action.

In this study each patient of different groups had received in total equal volume of drugs through supraclavicular approach for brachial plexus block to avoid bias and alteration in concentration of local anesthetics.

Commonly long acting local anesthetics like Bupivacaine is most commonly used to get long duration of anaesthesia and analgesia, but in our study we had chosen both drug Lignocaine with adrenaline and bupivacain.

Our findings are comparable with the study conducted by Shrestha B.R *et al.* 10 in 40 patients, they found complete sensory block in Dexamethasone Group (mean 14.5} 2.10 mins) which was statistically significant in comparison with controlled group. They had used a mixture of lidocaine 2% with 1:200,000 adrenaline and Bupivacaine 0.5% for a total volume of 40-50 ml.

Dexamethasone 4-8mg was added to the local anaesthetic solution in the steroid group. Time to complete sensory blockade was delayed in their study, it could be due to use of mixture of Lignocaine and Bupivacaine which might have altered individual concentration, pKAs and the pH of the solutions. Regarding duration of analgesia it was found prolonged in Dexamethasone group (12.75±5.33 hours) Vs (3.16 ±0.48 hrs) in local anaesthetic group which was statistically significant.

Ali movafegh *et al.* 11 in 60 adults had used either 34ml local anesthetics Lignocaine (1.5%) with 2 mL of isotonic saline chloride (control group, n = 30) or 34 mL Lignocaine (1.5%) with 2 mL of dexamethasone (8 mg) (dexamethasone group, n= 30). The duration of analgesia was comparable with our study. They observed prolonged duration of analgesia with dexamethasone group (242±76mins) Vs control group (98±33 mins) which was statically significant. The duration analgesia was less when compare with dexamethasone group of our study, it could be due to presence of local anaesthetic with adrenaline admixture and placement of position of needle of nerve stimulator while performing block.

In their study position of needle was considered to be acceptable when distal motor response was observed with output current of less than/equal to 0.7mA where as in our study position of needle was considered to be acceptable when distal motor response was observed with output current of less than/equal to 0.5mA. So, deposition of local anaesthetic was closer in vicinity of brachial plexus, as well as presence of local anaesthetic with adrenaline admixture could be the explanation for prolonged analgesic effect of our study. Apart from this addition of 2 ml dexamethasone might have altered the concentration of local anesthetics of their study drug could be another possibility of less duration of analgesia in their study.

It has been also observed that addition of small amounts of dexamethasone to local anesthetics prolonged duration of analgesia after subcutaneous, intercostals blockade, intra-articular and epidurally. In few study it was observed that systemic administration of Dexamethasone reduced pain.

Though actual mechanism of Dexamethasone in producing rapid block and prolonging duration of analgesia is not well understood but by reviewing various previous studies, the reason of prolongation of analgesia in our study could be due to local action of dexamethasone on nerve as well as systemic anti-inflammatory effect after being observed from peripheral site (BPB site) to systemic circulation. Other possibilities are alteration in k } channel of nerve cell thereby synergistic action with local anesthetics or, the action on corticosteroid receptor present in brain after being absorbed from periphery to systemic circulation.

Brachial plexus block is an easy and relatively safe procedure for upper limb surgery. A combination of Lidocaine and Bupivacaine has on for elective postoperative analgesia. Addition of 4 mg of Dexamethasone effectively and significantly prolongs the duration of analgesia as well as producing earlier onset of action. The early onset of action in steroid group is due to the synergistic action with local anaesthetics on blockage of nerve fibres. The block prolonging effect of Dexamethasone is due to its local action and not a systemic one. This effect is mediated via Glucocorticoid receptors. When steroid alone is used in regional blocks, the blockade is not produced. Steroids might bring about this effect by altering the function of potassium channels in the excitable cells, In our study, the average duration of analgesia was 14-18 hours with Dexamethasone, but only 4-6 hours with local anaesthetics without dexamethasone.

Conclusion

The randomized comparative study of Brachial plexus block with local anaesthetics, with and without Dexamethasone has revealed that postoperative analgesia has been found to be significantly prolonged in the Dexamethasone group and can be used safely Thus, in our study addition of Dexamethasone (4mg) to local anesthetics had fastest onset as well as complete blockade of sensory and motor nerves in comparison to other groups. It also showed prolonged duration of analgesia without side effects.

As far as the quick onset of action, duration of analgesia and number of analgesics required are concerned dexamethasone group appeared to be better than the other group.

References

1. Crile H. Great moments in the history of anaesthesiology in-A practice of anaesthesia 7th ed. London, UK: Lioyd-Luke, 2003, p.8.
2. Jeon DG, Kim W. Case series: ultrasound-guided supraclavicular block in 105 patients. Korean J Anesthesiol. 2010; 58(3):267-271.
3. Singh A, Gupta R, Vashisth M, Singh S, Kumari A, Aujla

KS. Comparison of Effectiveness of Brachial Plexus Block by Supraclavicular and Axillary Approach Alone or in Combination. J Anaesth Clin Pharmacol. 2010; 26(1):31-34.
4. Yang CM, Kwon HU, Cho CK, *et al*. A comparison of infraclavicular and supraclavicular approaches to the brachial plexus using neurostimulation. Korean J Anesthesiol. 2010; 58(3):260-266.
5. Neal JM, Gerancher JC, Hebl JR, Ilfeld BM, *et al*. Upper Extremity Regional Anesthesia: Reg Anesth Pain Med. 2009; 34(2):134-170.
6. Wakhlo R, Gupta V, Raina A, Gupta SD, Lahori VU. Supraclavicular Plexus Block: Effect of Adding Tramadol or Butorphanol as an Adjuncts to Local Anaesthetic on Motor and Sensory Block and Duration of Post-operative Analgesia. J Anaesth Clin Pharmacol. 2009; 25(1):17-20.
7. Gabriella I, Adnane M, Desire-Pascal D, *et al*. The effects of clonidine added to mepivacaine for paronychia surgery under axillary brachial plexus block. Anesth Analg. 2005; 100(4):1179-1183.
8. Lalla RL, Anant S, Nanda HS. Verapamil as an Adjunct to Local Anaesthetic for Brachial Plexus Blocks. MJAFI. 2010; 66:22-24.
9. Benzon HT. Epidural steroids. In: Raj PP, editor. Pain medicine, a comprehensive review. UK: Mosby Publications, 1999, p.259-263.
10. Glasser RS, Knego RS, Delashaw JB, Fessler RG. The perioperative use of corticosteroids and bupivacaine in the management of lumbar disc disease. J Neurosurg. 1993; 78:383-7.
11. Mirzai H, Tekin I, Alincak H. Perioperative use of corticosteroid and bupivacaine combination in lumbar disc surgery: a randomized controlled trial. Spine. 2002; 27:343-6.
12. Castillo J, Curley J, Hotz J, *et al*. Glucocorticoids prolong rat sciatic nerve blockade in vivo from bupivacaine microspheres. Anesthesiology. 1996; 85:1157-66.
13. Droger C, Benziger D, Gao F, Berde CB. Prolonged intercostals nerve blockade in sheep using controlled-release of bupivacaine and dexamethasone from polymer microspheres. Anesthesiology. 1998; 89:969-74.
14. Kopacz DJ, Lacouture PG, Wu D, *et al*. The dose response and effects of dexamethasone on bupivacaine microcapsules for intercostals blockade (T9 to T11) in healthy volunteers. Anesth Analg. 2003; 96:576-82.
15. Stan T, Goodman E, Cardida B, Curtis RH. Adding methylprednisolone to local anesthetic increases the duration of axillary block. Reg Anesth Pain Med. 2004; 29:380-382.