



A Comparative Evaluation of 0.5% Levobupivacaine in Combination with Dexamethasone and 0.5% Levobupivacaine alone in Nerve Stimulator Guided Supraclavicular Brachial Plexus Block for Upper Limb Surgeries: A Prospective Randomized Single Blind Controlled Study

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Abstract

Introduction: Brachial plexus block is a safe and well accepted technique of anaesthesia since it avoids the untoward side effects associated with general anaesthesia, resulting in more favorable outcome along with increased margin of safety. The aim of this study is to establish the role of dexamethasone as adjuvant to levobupivacaine in supraclavicular brachial plexus block.

Material and Method: A randomized single blind controlled study was done on 60 patients of ASA Grade I or II undergoing upper limb surgery. Group A received 30ml of 0.5% Levobupivacaine with 2 ml (8mg) Dexamethasone and group B received 30ml of 0.5% Levobupivacaine with 2 ml of 0.9% normal saline. Onset and duration of both sensory and motor blockade were studied in both the groups.

Results: It was observed that in group A, onset of sensory and motor blockade was faster than group B. Group A had longer duration of sensory and motor blockade in comparison of group B.

Conclusion: It was concluded that the addition of 8mg of dexamethasone to 0.5% levobupivacaine effectively and safely shortens the onset of sensory and motor blockade, increases the duration of sensory and motor blockade without any hemodynamic disturbances.

Keywords: Dexamethasone, Levobupivacaine, nerve stimulator, supraclavicular brachial plexus block.

Introduction

Orthopedic surgeries in upper limb can be performed under a variety of procedures including general anaesthesia, intravenous regional anaesthesia (Bier's block), brachial plexus block and individual nerve blocks. The selection of a particular technique depends on surgical

procedure, use of tourniquet and patient safety. Brachial plexus block is most frequently used technique because of excellent operative conditions, ease and safety of procedure.

Discovery of brachial plexus block was a milestone in history of anaesthesia. Prior to it, general anaesthesia was used to be administered

for upper limb surgeries but it's life threatening complications and need for stringent post-operative monitoring and care, results in increased cost of medical services and greater morbidity and mortality.

Brachial plexus block is a safe and well accepted technique of anesthesia, since it avoids the untoward side effects associated with general anaesthesia, resulting in more favorable outcome along with increased margin of safety especially in American Society of Anesthesiologists grade III and IV patients.

Brachial plexus block has increased its domain from operation theatre to post-operative analgesia and chronic pain management with reduction in requirements of opioid analgesics thereby reducing post-operative respiratory depression, nausea, vomiting and sedation along with reduced use of Non Steroidal Anti Inflammatory Drugs, thereby reducing bleeding tendencies and Non Steroidal Anti Inflammatory Drug induced peptic ulcers.

The first brachial plexus block was performed by William Stewart Halsted in 1884, in New York City at St. Luke's Roosevelt Hospital Centre.^[1] Halsted exposed the roots surgically under local infiltration and injected each of them with a small amount of 0.1 % cocaine under direct vision.

The first percutaneous block was performed independently in 1911 by Hirschel^[2] and Kulenkampff^[3] using the axillary and supraclavicular routes, reportedly on himself. The technique was published later in 1928, by Kulenkampff^[3] and Persky.^[4]

The supraclavicular route of Kulenkampff^[3] became the accepted approach because better standardized and larger series of cases were reported with greater success and less complications using this route.

The supraclavicular block is performed at the level of the brachial plexus trunks where almost entire sensory, motor and sympathetic innervations of the upper extremity is carried in just three nerve structures confined to a very small surface area. Consequently, typical features of this

block include rapid onset, predictability and dense anaesthesia.

Satisfactory surgical conditions are obtained with complete sensory and motor blockade. Concurrent sympathetic blockade reduces post-operative pain, vasospasm and edema.^[5]

The supraclavicular brachial plexus block is ideal for the proximal upper extremity but has been avoided by some because of the risk of pneumothorax. Most patients have readily identifiable landmarks, allowing easy access to the brachial plexus via supraclavicular approach. The use of nerve stimulator or ultrasound to guide proper needle placement rather than relying solely on paraesthesia, can increase the rate of a safe and successful block.

Currently bupivacaine, which is an amide local anaesthetic is the most frequently used local anaesthetic because of long duration.^[5] Several adjuvants have been studied to potentiate its efficacy including opioids, midazolam, neostigmine, bicarbonate, hyaluronidase, clonidine, dexmedetomidine and dexamethasone.^[6] The results have often been debated and counter debated but their utility remains questionable. Studies continue to find the ideal adjuvant which could provide further improvements in operative conditions without unwanted short or long-term side effects.

Material and Method

The study was conducted on 60 patients of American Society of Anesthesiologists grade I or II, adult of either sex, in the department of anesthesia & critical care, Rohilkhand Medical College & Hospital, Bareilly and cases were selected from orthopedics patients going to be operated under supraclavicular brachial plexus block. The study was conducted in two groups of 30 patients each. The patients were randomly assigned using "computer generated random number table" to one of the following groups:

Group A- Received levobupivacaine 0.5% (30ml) 150 mg with 2ml Dexamethasone (4mg/ml).

Group B- Received levobupivacaine 0.5% (30ml) 150 mg with 2ml normal saline.

After approval from institutional ethical committee, informed written consent was taken from all patients, pre-anesthetic checkup was done and patient was informed about the procedure. Tab. alprazolam 0.5 mg was given evening before surgery and at 5Am in the morning with a sip of water. IV line was secured with 18 Gauge IV cannula in healthy forearm and IV fluid was started. The patient was connected to all the standard monitors to record pulse rate, O₂ saturation, Non Invasive Blood Pressure and Electrocardiogram. Premedication with inj. Midazolam 0.05 mg/kg body weight, before the procedure was given. Drug solutions were prepared by an independent anaesthesiologist according to group of the patient. Base line heart rate, blood pressure and oxygen saturation were recorded.

Then patients were allowed to lie in a supine position with the head turned toward the non-operative side. Clavicle was divided into three parts i.e., medial, middle and lateral one third. By left hand finger we appreciated the pulsations of subclavian artery than 1cm above the clavicle at the level of middle and medial third of clavicle lateral to the pulsation of above mentioned site, 21G, 4 inch long, insulated stimuplex A (B Brawn) needle with extension tubing used. An ECG electrode was placed 6 centimeters away from site of needle insertion and positive cord was connected with ECG electrode and negative cord connected with needle. Needle was inserted downward, backward and medially till hitting the first rib. Stimulator (HNS 12, B Brawn) was initially set at 1.5mA (2.0Hz). Simultaneously we observed for muscle contraction of fingers than gradually decreasing up to 0.5mA with sustained contraction of muscles. When sustained contractions observed with appropriate current (0.5mA) prepared drug solution was injected following negative aspiration.

The onset of sensory blockade was defined as the time between injection and complete loss of pin

prick sensation. Motor blockade was assessed by Bromage three point score. The time when complete sensory and motor blockade achieved was noted.

Duration of sensory blockade (till appearance of pin prick sensations), duration of motor blockade (till complete return of muscle power) and duration of analgesia (first feel of pain by patient) was also recorded.

Statistical Analysis

Sample size was estimated before study using duration of motor blockade as a primary outcome. A sample size of 60 patients was required at $\alpha = 0.05$, $\beta = 0.001$ and power of study 95%. Statistical analysis of the data was done using the statistical package for the social science (SPSS 22.0) using independent t-test to determine mean significant difference between the two variables. $p < 0.05$ considered as statistically significant and $p < 0.001$ considered as statistically highly significant. The data was compiled using Microsoft excel sheet (windows 2007).

Observations

Both the groups were comparable in the terms of Age, Gender, Weight and ASA Grade and duration of surgery and no statistically significant difference was found ($p > 0.05$) (Table 1).

Onset of sensory and motor blockade was faster in group A in comparison to group B ($p < 0.001$) (Table 2).

Duration of sensory and motor blockade was longer in group A in comparison to group B ($p < 0.001$) (Table 2).

Mean pulse rate was comparable in both the groups on starting of procedure. Pulse rate changes during entire intraoperative period were statistically not significant in both the groups ($p > 0.05$) (Fig.1).

Mean systolic blood pressure was comparable in both the groups on starting of procedure. Systolic blood pressure changes during entire intraoperative period were statistically not significant in both the groups ($p > 0.05$) (Fig.2).

Mean Diastolic blood pressure was comparable in both the groups on starting of procedure. Diastolic blood pressure changes during entire

intraoperative period were statistically not significant in both the groups ($p > 0.05$) (Fig.3).

Table 1: Demographic Profile

Parameters	Group A (n=30)	Group B (n=30)	p-value
Age (Years)	38.1±13.88	34.6±12.16	0.302
Weight(Kg)	61.54±6.86	65.23±8.64	0.058
Gender (M/F)	26/04	22/08	0.569
ASA (I/II)	24/06	23/07	0.719
Duration of surgery	1241.5±21.5	134.9±17.5	0.453

Table 2: Onset and Duration of Motor and Sensory Blockade And Mean±S.D. (Minutes)

Variables	group A	group B	p-value
Onset of sensory blockade	6.22±2.24	14.27±3.36	0.001
Onset of motor blockade	10.14±2.20	20.87±3.92	0.001
Duration of sensory blockade	1075.83±196.08	630.83±153.57	0.001
Duration of motor blockade	915.70±189.92	551.43±155.32	0.001

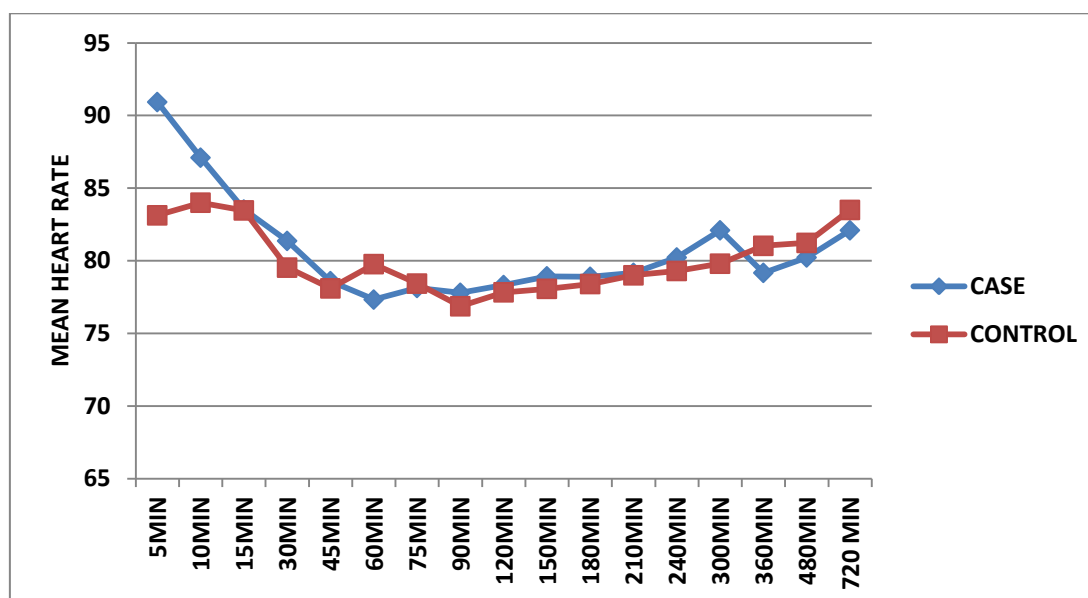


Fig. 1 : Comparison of mean heart rate

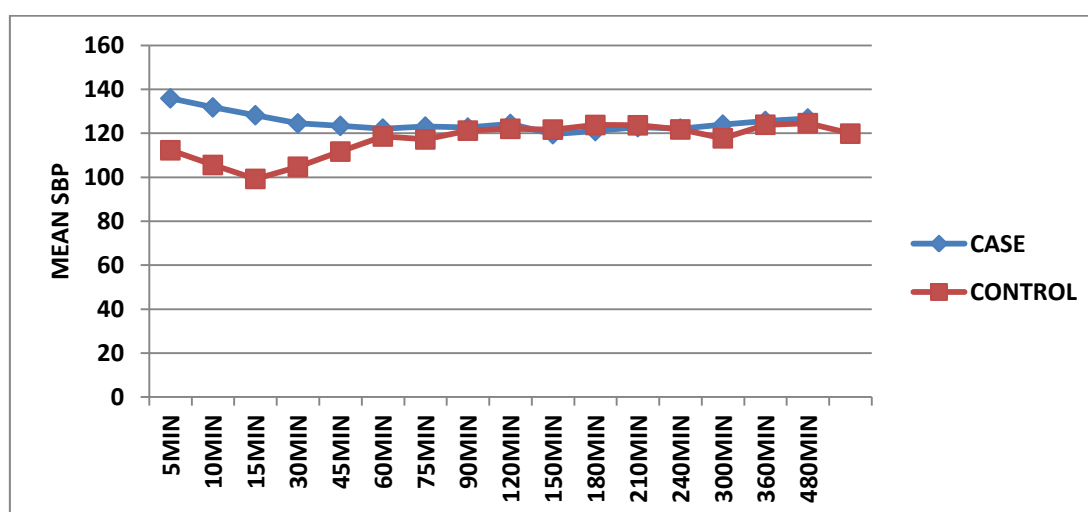


Fig.2: Comparison of mean systolic blood pressure

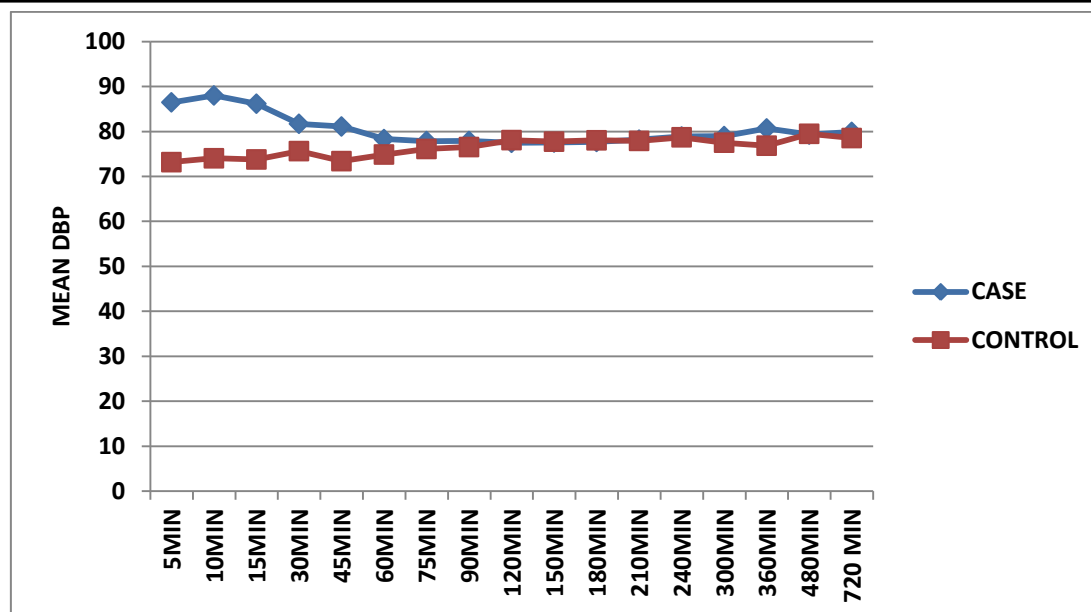


Fig.3: Comparison of mean diastolic blood pressure

Discussion

Brachial plexus blockade is one of the approaches to sensorimotor regional neural block by which surgical anaesthesia of the upper limb may be achieved. It is preferred in upper limb surgeries because it has certain advantages.^[7] It is safer in patients who are at high risk for general anaesthesia, provides good postoperative analgesia and is economical. The supraclavicular approach to brachial plexus block provides anaesthesia of the entire upper extremity in the most consistent and time efficient manner. It has a high success rate and rapid onset of action. It provides more complete anaesthesia of the plexus, particularly the axillary and musculocutaneous nerve, and does not require abduction of the arm to be performed.^[8] Peripheral nerve blocks have an increasingly important role in ambulatory anaesthesia.^[9]

Although many drugs are used as adjuvant to local anaesthetic drug in brachial plexus block, use of steroids is gaining popularity. Recently, dexamethasone has been studied as an adjuvant to local anaesthetic in peripheral nerve blocks.^[10] Steroids have nerve block prolonging effects by blocking transmission of nociceptive myelinated c-fibers and suppressing ectopic neuronal discharge. They are also thought to alter the function of potassium channels in the excitable

cells. Thus, dexamethasone was selected as an adjuvant to local anaesthetic (levobupivacaine) in this study because it has been reported to prolong duration of action of local anaesthetics with no respiratory depression.^[11]

Levobupivacaine has less systemic toxicity than bupivacaine^[12] but its limiting factors are late onset and short duration of analgesia even when used with adjuvant like opioids.^[13] Studies have shown that anatomy of the plexus dexamethasone can prolong the effect of regional anaesthesia.^[14] Dexamethasone as an adjuvant may avoid opioids related side effects. There is very limited literature available regarding the use of dexamethasone as an adjuvant to levobupivacaine. Hence, the study was designed to assess the characteristics of dexamethasone as an adjuvant to 0.5% levobupivacaine in supraclavicular brachial plexus block.

In the present study the onset of Sensory and motor blockade in group A was faster than group B. So it was observed that addition of dexamethasone as an adjuvant to local anesthetics for brachial plexus block makes sensory and motor onset earlier than local anaesthetic agent used alone. It may be due to synergistic action of dexamethasone with local anaesthetics on blockade of nerve fibers. These findings were in accordance with the study done by Pani N *et al.*^[15] who conducted a study to find out analgesic

efficacy of dexamethasone as an adjuvant to levobupivacaine in brachial plexus block. They found early onset of motor and sensory blockade in dexamethasone levobupivacaine group as compared to levobupivacaine alone. This difference in both groups was statistically highly significant ($p < 0.001$).

Similarly, in the randomized, double blind study done by Ritu Baloda *et al.*^[16], they found that the addition of dexamethasone to 0.5% levobupivacaine in supraclavicular brachial plexus block results in faster onset of sensory and motor blockade. Golwala MP *et al.*^[17] and Yadav RK *et al.*^[18] in their studies found significantly earlier onset of sensory and motor blockade in the local anesthetic dexamethasone combination as compared to local anesthetic alone.

However, Hanumansetty K *et al.*^[19] did not found earlier onset of sensory and motor blockade after addition of dexamethasone to 0.5% levobupivacaine, which is not in accordance with our study. Two more studies, which are inconsistent with our result, were done by Movafegh A *et al.*^[20] and Pathak *et al.*^[21] where they found no significant difference in the onset time of the sensory and motor blockade between two groups. They concluded that this discrepancy might be due to differences in study methodology such as use of varying methods of block assessment, higher dose of local anesthetic and use of adjuvant.

Although, dexamethasone has not proven its efficacy in reducing onset time of sensory and motor blockade as an adjuvant to local anesthetics in brachial plexus block, it produces vasoconstriction and reduces the absorption of local anesthetics and thereby prolongs the duration of action of local anaesthetics.^[22]

In our study, the duration of Sensory and motor blockade in group A was longer than group B. These findings are supported by the observations of various studies done by Hanumansetty K *et al.*^[19], Pani N *et al.*^[15] and Ritu Baloda *et al.*^[16] Movafegh A *et al.*^[12] used dexamethasone as an adjuvant to lidocaine in axillary brachial plexus

block and concluded that addition of dexamethasone prolonged the duration of sensory and motor blockade. Shrestha *et al.*^[23] found that addition of dexamethasone with local anesthetic in brachial plexus block leads to faster onset of sensory and motor blockade and prolonged duration of analgesia, without any unwanted side effects.

Kumar S *et al.*^[24] in a study found that addition of 8mg dexamethasone to 30 ml 0.5% ropivacaine in brachial plexus block, prolonged duration of sensory and motor blockade as compared to ropivacaine alone, but it had no effect on the onset of sensory and motor blockade.

In a meta analysis Knezevic NN *et al.*^[25] concluded that addition of dexamethasone to local anesthetic agent, produced late onset of sensory and motor blockade, with prolongation of duration of sensory and motor blockade and found that the smaller doses of dexamethasone (4 to 5mg) were equally effective as higher doses (8 to 10mg). The block prolonging effect may be due to its local action on nerve fibers and a systemic one.^[32] We observed that sensory blockade lasts longer as compared to motor blockade which was also observed by De Jong *et al.*^[26]

Conclusion

It was concluded that the addition of 8 mg of dexamethasone to 0.5% levobupivacaine effectively and safely shortens the onset of sensory and motor blockade and increases the duration of sensory and motor blockade without any hemodynamic disturbance.

References

1. Peripheral nerve blocks: Principles and Practice by AdmirHadzic, Jerry Vloka, New York School of Regional Anaesthesia, 2004; 4: 340.
2. Hirschel G: Die Anaesthesierung des Plexus Brachialis fuer die Operationen der oberen Extremitaet. Muenchen Med Wochenschr1911; 58: 1555.

3. Kulenkampff D: Die Anaesthesierung des Plexus Brachialis. *Zentralbl Chir* 1911; 38: 1337.
4. Kulenkampff D., Persky, M.A. Brachial plexus anesthesia: its indications, technique and dangers. *Ann. Surg.* 1928 June; 87: 833-891.
5. Lund PC, Cwik JC, Vallesteros F: Bupivacaine- a new long-acting local anesthetic agent. A preliminary clinical and laboratory report. *Anesth Analg* 1970; 49: 103-14.
6. Sarma BA, Sundari MR, Suman KVJ, Rao DBVM. Low dose dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*. 2015;14 (6) Ver. II:104-07.
7. Neal JM, Gerancher JC, Hebl JR, Ilfeld BM, McCartney CJ, Franco CD, Hogan QH. Upper extremity regional anaesthesia. *Reg Anesth Pain Med* 2009 Mar-Apr;34(2):134-170.
8. Hickey, Rosemary; Ramamurthy, Somayaji. Brachial plexus block. *Current Opinion in Anaesthesiology* 1993 Oct;6(5): 799-802.
9. Klein SM, Evans H, Nielsen KC, Tucker MS, Warner DS, Steele SM. Peripheral nerve block techniques for ambulatory surgery. *Anesth Analg* 2005;101(6):1663-1676.
10. Choi S, Rodseth R, McCartney CJ. Effects of dexamethasone as a local anaesthetic adjuvant for brachial plexus block: a systematic review and meta-analysis of randomized trials. *Br J Anaesth.* 2014;112(3):427-39.
11. Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without dexamethasone – a comparative study. *International Journal of Scientific and Research Publications.* 2012;2(12):1-7.
12. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. *Anesth Analg* 2006;102:263-7.
13. Chen SY, Liu FL, Cherng YG, Fan SZ, Leighton BL, Chang HC, et al. Patient controlled epidural levobupivacaine with or without fentanyl for post-caesarean section pain relief. *Biomed Res Int* 2014;2014:965152.
14. Cummings KC 3rd, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems JJ, et al. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. *Br J Anaesth* 2011;107:446-53.
15. Pani N, Routray SS, Mishra D, Pradhan BK, Mohapatra BP, Swain D. A clinical comparison between 0.5% levobupivacaine and 0.5% levobupivacaine with dexamethasone 8 mg combination in brachial plexus block by the supraclavicular approach. *Indian J Anaesth* 2017;61:302-7.
16. Ritu Baloda, Jatinder Paul Singh Bhupal, Parmod Kumar, Gurjit Singh Gandhi. Supraclavicular Brachial Plexus Block With or Without Dexamethasone as an Adjuvant to 0.5% Levobupivacaine: A Comparative Study. *Journal of Clinical and Diagnostic Research.* 2016 Jun;10(6): UC09-UC12. Golwala MP, Swadia VN, Dhimar AA, Sridhar NV. Pain relief by dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block. *J Anaesth Clin Pharmacol* 2009; 25(3):285- 8.
17. Golwala MP, Swadia VN, Dhimar AA, Sridhar NV. Pain relief by dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block. *J Anaesth Clin Pharmacol* 2009; 25(3):285-8.
18. Yadav RK, Sah BP, Kumar P, Singh SN. Effectiveness of addition of neostigmine or

- dexamethasone to local anaesthetic in providing perioperative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. Kathmandu University Medical Journal 2008; 6(23):302-9.
19. Hanumansetty K, Hemalatha S, Gurudatt CL. Effect of dexamethasone as an adjuvant to 0.5% levobupivacaine in supraclavicular brachial plexus block for upper extremity surgeries. Int J Res Med Sci 2017;5:1943-7.
20. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone Added to Lidocaine Prolongs Axillary Brachial Plexus Blockade. Anaesthesia& Analgesia. 2006;102(1):263-7.
21. Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without dexamethasone – a comparative study. Inter J Scien Rese Pub. 2012;2(12):1-7.
22. Bigat Z, Boztug N, Hadimioglu N, Cete N, Coskunfirat N, Ertok E. Does dexamethasone improve the quality of intravenous regional anaesthesia and analgesia? A randomized, controlled clinical study. Anesth Analg 2006; 102:605-9.
23. Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular brachial plexus block with and without dexamethasone – A comparative study. Kathmandu Univ Med J (KUMJ). 2003;1:158–60.
24. Kumar S, Palaria U, Sinha AK, Punera DC, Pandey V. Comparative evaluation of ropivacaine and ropivacaine with dexamethasone in supraclavicular brachial plexus block for postoperative analgesia. Anesth Essays Res 2014;8:202-8.
25. Knezevic NN, Anantamongkol U, Candido KD. Perineural dexamethasone added to local anaesthesia for brachial plexus block improves pain but delays block onset and motor blockade recovery. Pain Physician 2015;18:1-14.
26. De Jong RH, Wagman IH, Physiological mechanisms of peripheral nerve block by local anesthetics. Anesthesiology 1963; 24:684-727.