Original Article

Efficacy and Safety of Dexamethasone versus Fentanyl as an adjuvant with Bupivacaine and Lignocaine in Supraclavicular Brachial Plexus Block

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Abstract

Background: *Brachial plexus blockade is gaining popularity day by day for the upper extremity surgery. Increasing the duration of local anesthetic action by adding different adjuvant is often desirable to prolong the surgical anesthesia and analgesia. The aim of this study was to make a comparative evaluation of the efficacy and safety of dexamethasone and fentanyl as an adjuvant with bupivacaine-lignocaine in supraclavicular block.* ***Material and methods:*** *This comparative study was carried out in the department of anesthesiology in Chittagong Medical College Hospital in collaboration with the department of orthopedic surgery over a period of 22months starting from July, 2012 to April, 2014. A total 130 adult patients of either sex with American Society of Anesthesiology (ASA) health status I-II were selected for upper limb surgery under supraclavicular brachial plexus block was randomly allocated in to two groups of 65 patients in each. Group- D was received dexamethasone 2ml (10mg) and Group-F was received fentanyl 2ml (100μg) in 38ml of bupivacaine and lignocaine with adrenaline (total volume of 40ml).* ***Result****: The mean onset of sensory&motor block was 7.72±1.949min & 8.75±2.008min in group-D and 7.60±3.711min & 9.23±5.114min in group-F. Both the results in two group was not statistically significant (p>0.05).The duration of analgesia in group-D was 11.40±0.844hrs and in group-F was 8.62±1.747hrs.The results was significantly higher in group-D than group-F (p<0.05).* ***Conclusion:*** *There was significantly prolonged duration of analgesia and better onset of sensory and motor block in dexamethasone group than in fentanyl group without any unwanted effects.*

Keywords: *Supraclavicular brachial plexus block; Dexamethasone; Fentanyl; Bupivacaine; Lignocaine; Adjuvant.*

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Introduction

Brachial plexus block is a versatile and reliable regional anesthetic technique employed as an alternative to general anesthesia for upper limb surgery. This technique involves the injection of local anesthetic agents in close proximity to the brachial plexus, temporarily blocking the sensation and ability to move the upper extremity. The subject remains awake during the ensuing surgical procedure.

Regional nerve block avoids the unwanted effects of anesthetic drugs used during general anesthesia and the stress of laryngoscope and tracheal intubation. Minimizing the stress response and using minimal anesthetic drugs is always beneficial for the patients and provides optimal surgical condition with prolonged postoperative analgesia. Patient's safety, surgeon's satisfaction and quicker initial recovery are among the other benefits of regional anesthesia. Thus it is gaining

popularity day by day for the upper limb surgery.[1-3]

The supraclavicular block of the brachial plexus has many advantages over other approaches to brachial plexus block.[4-6] It is performed at the trunk level where the plexus is presented most compactly. This anatomical compactness is responsible for complete and reliable anesthesia. Another advantage is that it can be performed with the patients arm in any position to provide excellent anesthesia for elbow, forearm and hand surgery.[7]

Mixture of local anesthetics provides few clinically significant advantages. But the onset of action and duration of anesthesia are the limiting factors. Lignocaine is an effective local anesthetic of amide group, with a rapid onset of action and lasts for 60-90 minutes. It has a tendency to cause vasodilatation and this is normally counteracted by the addition of a vasoconstrictor. Adrenaline is used with lignocaine to delay absorption and prolong the action. Bupivacaine is a local anesthetic of amide group, four times more potent than lignocaine, slower in onset but has a significantly longer duration of action.[8, 9]

However local anesthetics provide analgesia for not more than 4-8 hrs. Increasing the duration of local anesthetic action is often desirable because it prolongs surgical anesthesia and analgesia. But the results are either inconclusive or associated with side effects like heavy sedation, respiratory depression and psychomimmetic effects. Drugs with minimal side effects are always looked for.

Steroids when used intrathecally are reported to cause arachnoiditis but there is no evidence suggesting any neuritis when steroids are used in low concentration in peripheral nerve blocks. Steroids have powerful anti-inflammatory as well as analgesic property. Perineural injection of steroids is reported to influence postoperative analgesia. They relieve pain by reducing inflammation and by blocking transmission in nociceptive myelinated C fibers and suppressing ectopic neuronal discharge.[10] A study in supraclavicular brachial plexus block suggest that dexamethasone when added to lignocaine results in a faster onset and prolonged duration of sensory and motor blockade.[11]

It has been suggested since long, that peripheral nerve possess opioid receptors and this has tempted clinicians to add narcotics to local anesthetics to prolong the analgesic effects of these solutions. The peripheral administration of opioids provides stronger and longer lasting analgesia with a lower dose of opioid without central side effects such as respiratory depression, nausea, vomiting and pruritus.

With this background, several studies are carried out to evaluate the efficacy of fentanyl or dexamethasone as an adjuvant to local anesthetics in Supraclavicular brachial plexus block.

Till date, no study have compared dexametosone with fentanyl in respect to quality, onset and duration of sensory and motor block, sedation and post operative analgesia in our country.

Considering the fact, the current study was planned to compare the anesthetic and analgesic effects of adding fentanyl or dexamethasone to bupivacaine-lignocaine in supraclavicular brachial plexus block for upper limb surgery.

Materials and Method:

All patients of both sexes, age 18-60 years, ASA class-I & class-II undergoing routine operation schedule for upper limb surgery under supraclavicular brachial plexus block were enrolled in this study. Patients were excluded if they had sepsis at the site of injection, body wt <50kg, pregnant women, known hypersensitivity, circulatory instability, diabetes, coagulopathy, history of neurological, renal & liver diseases, peptic ulcer disease.

Patients were randomly selected by card sampling method into two groups. Sample size was 65 in each group. A box was prepared containing 130 cards (F-card & D-card in equal numbers). Randomization of the sample was done by asking the patient to draw one card blindly from the box. The patients who drew card marked F were allocated into group-F and patients with card marked D were assigned to group-D. After selecting the patient entry of the name of the patients in the case record form and initial pulse, NIBP (noninvasive blood pressure), RR (respiratory rate), saturated pluse oximetry (SPO_2) were monitored and were recorded as base line value.

Group-D received Dexamethasone 2ml (10 mg) and Group-F received 2ml (100µg) in 38ml of Bupivacaine and Lignocaine with adrenalin.

After block given, Patients pulse, blood pressure, RR, SPO_2 were recorded and then first 30 mins at 10 mins interval then 15 mins interval up to the end of surgery.

The onset of sensory block was assessed in every minute using pin prick method in different areas innervated by radial, ulna, median and musculocutaneous nerve. The onset of motor block was assessed in every minute by modified bromage scale compared to the opposite limb by asking the patient to raise their hand or move their fingers. The time of onset of sensory block (the time elapsed between the injection of local anesthetic drugs and just impaired sensation to pinprick perception i.e. grade1 compared to the opposite upper limb). The time of onset of motor block (the time elapsed between the injection of local anesthetic drug and just impaired ability to raise the hand i.e. grade1 of modified bromage scale, compared to the opposite limb) was noted. Duration of block (time between onset of sensory anesthesia and patient complaining of pain visual analog scale>3) and quality of block by Numeric scale was noted.

Any incidence of nausea, vomiting, pruritus, respiratory distress, dryness of mouth, local anesthetic toxicity, pneumothorax, hematoma formation or any others was noted by yes/no. If respiratory distress develops; phrenic nerve block and Pneumothorax were excluded by X-ray chest posterior anterior view. If any side effects detected clinically in per and post operative period then it was managed according to the need. The patient who needed sedative drug assessed by Ramsay Score was recorded.

Postoperative analgesia was noted by interviewing the patient according to visual analog scale (VAS) and Verbal rating scale (VRS) in post operative ward.

The sociodemographic variables studied were age, sex and weight. The preoperative variables were pulse, blood pressure, SpO2, respiratory rate. The outcome variables were the assessment of sensory and motor block, onset time of sensory and motor block, duration of surgery, duration of anesthesia, adjuvant required, sedation score, G /A required, quality of block, side effects monitored as well as per-operative hemodynamic stability by recording pulse, NIBP, SPO_2 and RR. Postoperative variables on analgesic demand by VAS and VRS to determine analgesic demand. A structured case record form was developed containing all the variables of interest. Proper permission was taken for this study from the ethical committee of Chittagong Medical College.

Collected data was complied, checked and edited. Data processing and analysis was done with the help of computer using statistical software SPSS(Statistical Package for Social Sciences) version -18(Chicago, IL, USA).. The test statistics used for analysis of data was Student's t-test (for comparison of data presented in quantitative scale-age, sex, wt), Chi-square test (for comparison of data presented in categorical scale-outcome in both groups). The results were presented in tables and figures. The statistical terms was included in this study are mean, standard deviation, percentage. Statistical significance was set at $p<0.05$ and confidence interval set at 95% level.

Results

The mean onset of sensory & motor block was 7.72±1.949& 8.75±2.008min in group-D and 7.60±3.711& 9.23±5.114min in group-F. Both the results in two group was not statistically significant ($p>0.05$). [Table-1]

The duration of analgesia in group-D was 11.40±0.844hrs and in group-F was 8.62±1.747hrs.The results was significantly higher in group-D than group-F ($p<0.05$). [Table-2]

The side effects of procedure and the drug of study patients where 2 case of ptosis in group-D and 3 case of ptosis, 1 case of hematoma in group-C. Total 4.6 %($p=0.680$). [Table-3]

Preoperative variables pluse, SBP, DBP, SPO2, resp. rate have no effect on drug group. [Figure 1, 2, 3]

Table 1 *Onset of sensory and motor block in study patients (n=130)*

	Group D (n=65)		Group F (n=65)		p value*
	Mean	±SD	Mean	±SD	
Onset of sensory block (min)	7.72	1.949	.60	.711	0.813
Onset of motor block(min)	8.75	2.008	9.23	.114	0.485

*(Calculated by t- test)

Table-II *Duration of analgesia between the study groups (n=130).*

	Group D (n=65)		Group F(n=65)		p value*
	Mean	±SD	Mean	±SD	0.001
Duration of analgesia (hrs)	11.40	0.844	.62	1.747	

*(Calculated by t- test)

Table-III *Side effects observed in the study patients (n=130)*

Side effects	Group D(n=65)		Group C(n=65)		Total	
	No.	%	No.	%	No.	%
Hematoma formation	0	0	1	1.5	1	4.6
Ptosis	2	3.1	3	4.6	5	
None	63	96.9	61	93.8	124	95.4

* (Calculated by Chi square test)

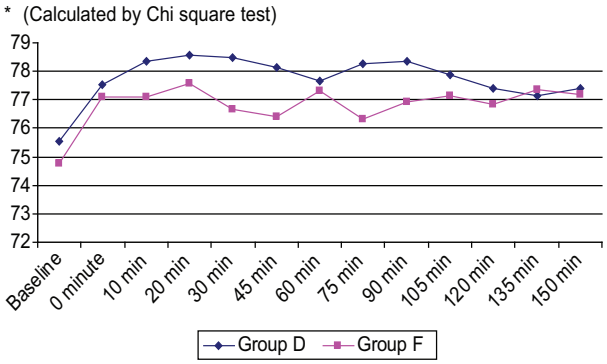

Figure 1: *Per operative monitoring of pulse of the study patients (n=130)*

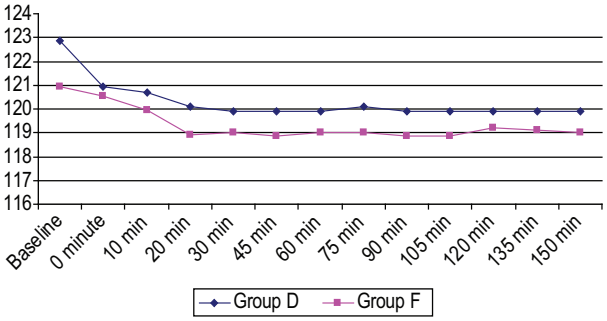

Figure 2: *Per operative monitoring of systolic blood pressure of the study patients (n=130)*

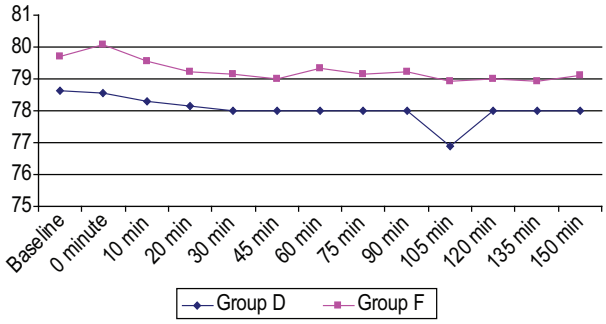

Figure 3: *Per operative monitoring of diastolic blood pressure of the study patients (n=130)*

Discussion

The present study which is a prospective comparative randomized clinical trial was carried out with the objectives to make a comparative evaluation of the efficacy and safety of dexamethasone and fentanyl as an adjuvant with bupivacaine-lignocaine in supraclavicular block during upper limb surgery.

Regarding the mean onset of the sensory block in group-F and group-D was 7.60±3.71min and 7.12±1.949min (p=0.813). The mean onset of the motor block in group-F and group-D was

9.23±5.114min and 8.75±2.008min (p=0.485 respectively). Both these data were not significant statistically as pÃ0.05. So in present study showed that there was no significant difference in the onset time of sensory and motor block between two groups.

As compared to the study done by Sarkar et al, where 1ml (50ìg) fentanyl was used in Lignocaine (2%) with adrenaline (1:2, 00,000) 10ml + bupivacaine (0.5%) 20 ml + distilled water 10ml, to make total volume of 40ml, in Supraclavicular block using nerve stimulator technique.[12] Onset time of the sensory and motor block was 4.4±1.41min and 3.04±1.31 min respectively. This does not correlate with the present study done by paraesthesia technique. In a study, Ahmed et al**,** used 100ìg fentanyl in 40ml of 0.25% of bupivacaine in the supraclavicular approach in paraesthesia technique.[13] And achieved the onset of the sensory and motor block at 8.9±2.9 min and 8.8±2.7 min, respectively. The results nearly matched with the present study. Almost similar result was depicted in a comparative study carried out by Chavan and colleagues**,** by addition of Fentanyl to local anesthetics (Bupivacaine 0.5% and Lignocaine 2%) undergoing surgery of forearm and hand with Supraclavicular approach and revealed that the gripping forces significantly decreased 10 minutes after the injections.[14] In a study by Shrestha BR et al, brachial plexus block was done by paraesthesia technique with 40-50 ml of local anesthetic with 1:200.000 adrenalines plus 4-8mg dexamethasone.[15] Onset of action was 10-20 minutes (mean14.5±2.10). As compared to the study done by Islam et al, who used 2% lignocaine and 0.5% bupivacaine plus dexamethasone 8mg in supraclavicular block.[16] Achieved the onset of the sensory and the motor block at 9.89±1.97min and 11.09±1.28mim, both of the study results nearly matched with the present study. This does not correlate with the study done dexamethasone and fentanyl as an adjuvant with bupivacaine-lignocaine in supraclavicular block during upper limb surgery. by Pathak et al; in brachial plexus block, performed by nerve stimulator technique.[17] They found that the onset time of sensory and motor blockade at 5.92 min and 15.8 min in local anesthetic (1.5% adrenalized xylocaine 20ml and 0.5% bupivacaine 16ml) plus dexamethasone group. The onset of sensory block was faster than motor block in both groups in this study which was similar in most of the study done in brachial plexus block. But the study done by Jarbo et al and Shrestha et al, have shown in their study, the onset time of motor block was significantly faster than the onset of the sensory block, which does not correlate with those found in present study.[18,19] This can be explained by the "core and mantle concept" of Winnie.[20] As described by Winnie, the outer motor fibers are blocked earlier than the sensory fibers which are situated deeper in the brachial plexus at the level of trunk and division. But the earlier time to achieve the sensory block than motor in present study, as compared to theirs, can be attributed to the mixture of local anesthetics which were used.

The duration of analgesia in present study was demonstrated that mean duration of analgesia was significantly longer in group-D (11.40±0.844) than that produced by group-F (8.62±1.74). P<0.001, which was highly significant between two groups.

As compared to the study, the duration of analgesia with local anesthesia plus dexamethasone in brachial block in the study by Shrestha BR et al was 12 hrs.[15] As compared to the study done by Islam et al, who achieved 11.87±.53hrs in local anaesthetic plus dexamethasone group.[16] Both the study was nearly matched with this present study. Similarly many previous studies, Birader et al (326±58.6 min), Pathak et al (834±78.1 min), Parrington et al (332min) reported early onset and marked prolonged supraclavicular brachial plexus block without any unwanted effects by using dexamethasone to local anesthesia[11,17,21]. Regarding the duration of analgesia with fentanyl in brachia plexus block in a study by SP Singh and colleagues, they found the duration was maximum with the addition of fentanyl to local anesthetic (7.28±0.55 hrs).[22] Similar result was depicted in a comparative study carried out by Chavan and colleagues to evaluate the analgesic efficacy and side effects of addition of fentanyl to local anaesthetics[14]. The study revealed that mean duration of analgesia was extended (695±85 min), if fentanyl is added to local anesthetics without increasing the side effects, however onset time of

analgesia was prolonged. Both the results nearly matched with the present study. Similarly, there were number of study regarding duration of analgesia, such as in Ahmed et al was 10±1.5 hrs and Sharker et al was 11 hrs, Denz et al was 10.1 hrs[13,12,23] These results were also nearly matched with this present study.

Regarding the complications the present study was showing side effects of 1(1.5%) case of hematoma in group-F and ptosis was found in 5(3.8%) cases in each groups. All above side effects were related to procedure rather than drug. Others side effects like nausea, vomiting, pruritus, respiratory distress, dryness of mouth, LA toxicity, pneumothorax was not found in both groups.

The side-effects reported after opioids administration in a study done by Bazin et al, was pruritus (1), nausea (2), vomiting (3).[24] However, such side-effects were relatively rare and their incidence was similar to that reported previously.[25] The serious potential risk of opioid administrations respiratory depression, although it seems a small risk in young patients given the doses of opioids currents used. Moreover, all the side-effects observed in Bazin et al study took place during the first 6h following the injection. This suggests that blood level became very low after this time. Regarding the safety of dexamethasone use in nerve sheath may raise some concerns. In Sugita K et al study, after approximately 2000 intrathecal injection of dexamethasone (8mg) in 200 patents for treatment of posttraumatic visual disturbance, no neurological disorder found at 1-month follow up. Nerve injury is a rare complication of dexamethasone injection, and it usually occurs in the context of needle trauma. The neurological risk, if any, of dexamethasone thus appears to be small[26].

In the present study the baseline characteristics were within normal value between two groups. The mean difference of pulse and blood pressure were not statistically significant ($p>0.05$), which indicates that almost similar pulse rate and blood pressure were found between two groups, which support the Jarbo et al.Study[18]. In this study it was observed that per-operative mean pulse rate changes at different times were almost similar between two groups no significant ($p>0.05$) mean difference was found. Similarly mean systolic blood pressure and diastolic blood pressure changes at different times were almost consistent between two groups and no significant ($p>0.05$) difference were found. The mean $SP0_2$ and respiratory rate changes at different times were almost regular between two groups and no significant ($p>0.05$) difference were found. Jarbo et al**.** found the heart rate, systolic blood pressure, diastolic blood pressure, oxygen saturation were comparable between groups and did not change significantly in the Intraoperative or postoperative period, which is closely resemble with the present study[18]. In another study Dogru et al. showed stable hemodynamic parameters in their study groups, which support the present study findings.[27]

Limitation and recommendations of the study:

It was a single center study. Relative perception of pain by the patients may have caused biasness regarding postoperative pain assessment by VAS and VRS and that could have affected the findings of the present study. Availability of an ultrasound and/or peripheral nerve stimulator would have helped to achieve more accurate nerve blocks.

Large scale multicenter double blind study with nationally representative sample and nerve stimulator or ultrasound guided techniques, find more accurate result to have a conclusion.

Conclusion

In this comparative study, main comparison was done on duration of analgesia by use of Dexamethasone and Fentanyl as an adjuvant with Bupivacaine and Lignocaine in Supraclavicular brachial plexus block. In our study Dexamethasone was more prolonged duration of analgesia than Fentanyl. Onset of sensory and motor block and hemodynamic stability was almost similar in both groups.

So, on the basis of student's t-test and Chi-square test, we can conclude that there was significantly prolonged duration of analgesia and better onset of sensory and motor block in Dexamethasone group than in Fentanyl group without any unwanted effects.

Discloser

All the authors declared no competing interest.

References

1. Wedel DJ, Harlocker TT, Nerve blocks. In: Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL, eds. Miller's Anesthesia. USA: Elsevier Churchill-Livingstone; 7th Ed.2010; 1639-1674.
2. Madison SJ, Llfeld BM, Peripheral nerve blocks. In: Butterworth JF, Makey DC, Wasnick JD, eds. Morgan & Mikhail's Clinical anesthesiology. USA: Appleton & Lange; 5th Ed.2013; 975-1022.
3. Benzon Honorio T.and Raja Srinivas, Local Anesthetic and Nerve Blockade. In: Essentials of Pain Medicine & Regional Anesthesia, Churchill Livingstone, Newyork, 1st Ed. 2001; 393-414.
4. Jeon DG, Kim W. Case series: ultrasound-guided Supraclavicular block in 105 patients. *Korean J Anesthesiol*. 2010; 58(3): 267-271.
5. 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.
6. Yang CM, Kwon HU, Cho CK, et al. A comparison of Infraclavicular and Supra-clavicular approaches to the brachial plexus using neuro stimulation. *Korean J Anesthesiol* .2010; 58(3): 260-266.
7. Neal JM, Gerancher JC, Hebl JR, IIfield BM, et al. Upper Extremity Regional Anesthesia: Reg Anaesth Pain Med.2009; 34(2): 134-170.
8. Neal MJ, Hebl JR, Gerancher JC, Hogan QH. Brachial Plexus Anesthesia: Essentials of Our Current Understanding. Reg Anesth and Pain Med.2002; 27: 402–428.
9. Covino BG, Wildsmith JAW. Clinical pharmacology of local anesthetic agents. In: Cousins MJ, Bridenbaugh PO, eds. Neural blockade in clinical anesthesia and management of pain. Philadelphia: Lippincott-Raven Publishers; 3rd Ed.1998; 97-128.
10. Prithvi PR. Pain medicine a comprehensive review.2005; New York: Mosby publication.
11. Biradar PA, Kaimar P, Gopalakrishna k. Effect of Dexamethasone added to Lignocaine in Supraclavicular brachial plexus block: A prospective, randomized, double-blind study.2013; *Indian J Anaesth*; 57:180-184.
12. Sarker D, Khurana G, Chaudhary A, Sharma JP. A comparative study on the effects of adding fentanyl and Bupivacaine to local anaesthetics in brachial plexus block. *Journal of clinical and Diagnostic Research*.2010; 4:3337-3343.
13. Ahmed NU, Hossain M, Akhtaruzzaman AKM, Mondol MK , Khatun UHS. Addition of clonidine or fentanyl with Bupivacaine for Supraclavicular brachial plexus block in upper limb surgery-a randomized comparative study.Journal of BSA.2011; 24(1).
14. Chavan SG, Koshire AR, Panbude P. Effect of addition of Fentanyl to local anesthetic in brachial plexus block on duration of analgesia. *Anesthesia: Essays and Reaches*.2011; 5(1): 39-42.
15. Shrestha BR, Mahrjan SK and Tabedar S. ' Supraclavicular brachial plexus block with and without dexamethasone- A comparative study', Kathmandu University Medical Journal.2003; 1(3); 158-160.
16. Islam SM, Hossain MH MD, Maruf AA, 2011. Effect of addition of Dexamethasone to local anesthesia in Supraclavicular brachial plexus block. *JAFMC Bangladesh*.2011; 7(1).
17. Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with & without Dexamethasone-A Comparative Study. International Journal of Scientific and Research Publication.2012; 2 (12), 2250-3153.
18. Jarbo K, Bara YK, Panda NB. Brachial plexus block with midazolum and Bupivacaine improves analgesia. *Can J Anaesth*.2005; 52: 822-6.
19. Shrestha BR, Maharjan SK, Shrestha S, Gautam B, Thapa PB, Joshi MR. 'Comparative study between tramadol and

dexamethasone as an admixture to bupivacaine in supraclavicular brachial plexus block', *J Nepal Med Assoc*. 2007; 46(168); 158-164.

20. Winnie AP, Tay CH, Patel KP, Ramamurthy S.Durrani z. Pharmacokinetics of local anaesthesia during plexus block. Anaesth Analg.1977; 56: 852-61.
21. Parrington SJ, Donnell DO, Chan VW.S, Shreves DB, Subramanyam R, Brull R. Dexamethasone added to mepivacaine prolongs the duration of analgesia after Supraclavicular brachial plexus blockade. *Reg Anesth Pain med*.2010; 35: 422-426.
22. Singh SP, Singh V, Kaushal D, Jafa S. Comparison of Fentanyl-Bupivacaine and Alkalinized Bupivacaine in Supraclavicular brachial plexus block: A double blind, randomized controlled trial. Available from: http://www.aja-online.com.pdf. Accessed on 20.6.2011.
23. Deniz K, Fazl B, Sibel B, Fuat G, Ayla T. Addition of Fentanyl to Bupivacaine prolongs anesthesia and analgesia in axillary brachial plexus block. *Reg Anesth Pain Med*.2001; 26: 434–438.
24. Bazin BZ, Massoni C, Bruelle P, Fenies V, Groslier D, Schoeffler P. The addition of opioids to local anesthetic in brachial plexus block: the comparative effects of morphine, buprenorphine and suefentanil. Anaesthesia. 1997; 52: 858-862.
25. Gobeaux D, Landais A, Bexon G. Addition of fentanyl to adrenalized lidocaine for the brachial plexus block. Anesthesiology. 1987; 35: 195-9.
26. Sugita K, Kobayash S, Yokoo A, et al. Intrathecal steroid therapy for posttraumatic visual disturbance. Neurochrurga(stuttg). 1983; 26:112-7.
27. Dogru K, Duygulu F, Yildiz K, Kotanoglu MS, Madenoglu H, Boyaci A, 2003, 'Hemodynamic and blockade effect of high/low epinephrine dose during axillary brachial plexus blockade with lidocaine 1.5%: A randomized, double blinded study', *Anesth Pain Med*.2003; 28(5): 401-405.