Evaluation of Dexamethasone as an adjuvant to Bupivacaine in ultrasound guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries

Elsayed Elsayed Ahmed Elfeky, Ali Abdullah Alkumity and Mohamed Mahmoud Ali Dawoud

Department of Anesthesia and Intensive Care, Faculty of Medicine, Al-Azhar University, Egypt
mohamed.dawoud.581187@facebook.com

Abstract: Background: Supraclavicular brachial plexus block (SBPB) is an effective nerve block for use during upper limb surgery as an alternative to general anesthesia. In addition, this block has postoperative analgesic effect for these surgeries. **Objective:** Evaluating the efficacy of dexamethasone as an adjuvant to bupivacaine in an ultrasound-guided supraclavicular brachial plexus block (SBPB). **Patients and Methods**: We compared two groups of patients; each group included 20 patients scheduled for upper limb surgeries and anesthetized by SBPB. Group A(was anesthetized by an injection of 20 ml bupivacaine 0.5% mixed with2 ml normal saline), and group B(was anesthetized by an injection of 20 ml bupivacaine 0.5% mixed with 2 ml (8) mg dexamethasone). The two groups were assessed for efficacy of the block by assessment of the onset and duration of sensory and motor block and assessment of the quality and duration of postoperative analgesia. The two groups were assessed for the incidence of complications. **Results**: The addition of dexamethasone to bupivacaine in ultrasound guided SBPB significantly hastened the onset and prolonged the duration of sensory and motor block. Dexamethasone yielded better quality of postoperative analgesia and significantly longer duration of postoperative analgesia. **Conclusion:** The addition of dexamethasone to bupivacaine in ultrasound-guided SBPB significantly decreased the onset time and prolonged the duration of sensory and motor blockade. Also, it prolonged the duration and improved the quality of postoperative analgesia, with very few incidences of complications**.**

[Elsayed Elsayed Ahmed Elfeky, Ali Abdullah Alkumity and Mohamed Mahmoud Ali Dawoud. **Evaluation of Dexamethasone as an adjuvant to Bupivacaine in ultrasound guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries.** *N Y Sci J* 2016;9(12):62-65]. ISSN 1554-0200 (print); ISSN 2375-723X (online). http://www.sciencepub.net/newyork. 10. doi:10.7537/marsnys091216.10.

Keywords: Dexamethasone, bupivacaine, supraclavicular block.

1. Introduction

Supraclavicular brachial plexus block (SBPB) is ideal for procedures of the upper limb from the mid-humeral level down to the hand. The brachial plexus becomes most compact at the level of the trunks formed by the C5–T1 nerve roots. Thus, blockade here has the greatest likelihood of blocking all of the branches of the brachial plexus **(Singh *et al*., 2010)**. Successful SBPB relies on proper techniques of nerve localization, needle placement, concentration and the volume of local anesthetic used **(Neal *et al*., 2002).** Ultrasound- guided techniques are based on direct ultrasound visualization of nerves, needle and adjacent anatomic structures, which give the possibility to apply the local anesthetic precisely around nerves, and to follow its dispersion in real time, achieving a more effective blockade **(Marhofer *et al*., 2003)**. Local anesthetics alone does not prolong the duration of analgesia **(YaDeau *et al*., 2007)**. Increasing duration of local anestheticaction is often desirable because it prolongs surgical anesthesia and analgesia. Different additives have been used to prolong the duration of blockade and thus improve the quality of anesthesia and postoperative analgesia **(Wakhlo *et al*., 2009).** Perineural clonidine increasing the duration of analgesia approximately 18 hours **(YaDeau *et al*., 2008)**. Steroids have a powerful anti-inflammatory as well as an analgesic property. Steroid extend duration of sensory block **(Myeong *et al*., 2016).** A meta-analysis found that addition of dexamethasone to local anesthetics prolonged brachial plexus block **(Choi *et al*., 2014).** It was proved to be beneficial in peripheral nerve block **(Albrecht *et al*., 2015)**. A perineural injection of steroids is reported to influence postoperative analgesia **(Islam *et al*., 2011**). Also, it prolongs regional anesthesia as it induces a degree of vasoconstriction. One theory stated that the drug acts by reducing local anesthetic absorption. A more attractive theory holds that dexamethasone increases the activity of inhibitory potassium channels on nociceptive C-fibers (by glucocorticoid receptors), thus decreasing C-fibers activity **(Wakhlo *et al*., 2009).**

2. Materials and Methods

The protocol was approved by the research ethics committee and patients provided written informed consent. The evaluation included forty adult patients in the age group of 18 to 60 years admitted at Al-Azhar University Hospitals, ASA physical status I or

II patients scheduled for upper limb surgeries received ultrasound-guided SBPB.

Exclusion criteria included: Cardiac dysfunction or pulmonary impairment, chest or shoulder deformities, infection at the injection site, coagulopathy and allergy to local anesthetics.

Patients were randomized by computer-generated Random selection into two equal groups: Group A received ultrasound-guided SBPB by an injection of 20 ml of bupivacaine 0.5% mixed with 2 ml normal saline and group B was anesthetized by an injection of 20 ml of bupivacaine 0.5% mixed with 8 mg (2 ml) dexamethasone.

Applying routine monitors included: ECG, noninvasive arterial pressure and pulse oximetry. Patients were administered 2 mg of midazolam intravenously as a premedication immediately before beginning. All patients received 3 ml lignocaine 2% at the injection site. Ultrasound-guided SBPB was performed using a 22 G 1.5 inch needle inserted in-plane with the ultrasound probe in the transverse cut. A 7.5–12 MHz probe was used to visualize the brachial plexus. It was placed in the supraclavicular region in the transverse position. We used a SonoSite M turbo Ultrasound machine manufactured in China in the present study. Heart rate (HR), mean arterial blood pressure (MABP), oxygen saturation and respiratory rate were monitored every 3 minutes throughout the block and operation and recorded immediately before the block (baseline) and then every 15 minutes during the surgery.

The onset and depth of sensory block were evaluated at 5, 10, 15, 20, 25 and 30 minutes after the block: The extent of sensory blockade was tested by pinprick in the median, radial, ulnar and musculocutaneous nerve distribution using a three-point score: 2 = normal sensation, 1 = loss of sensation to pinprick (loss of pain sensation) or 0 = loss of sensation to light touch. Sensory block onset was defined as a decrease of sensation to grade 1 or less in comparison with the contralateral limb as a reference. Sensory block duration was defined as the time from the injection of a local anesthetic mixture to complete recovery of light touch and pain sensation as tested by a swab and pinprick, respectively.

The quality of motor block was evaluated using a three- point scale, where 2 = normal movement, 1 = paresis (weak hand grip) and 0 = absent movement: Onset of motor block was defined as the time from injection of a local anesthetic mixture until achieving a reduction in motor power to grade 1 or less. Motor block duration was described as the time from injection of a local anesthetic to complete recovery of motor function. Block success was defined as loss of sensation to pinprick (sensory score 1 or less) in each of the radial, ulnar, median and musculocutaneous nerve distributions measured within 30 min after the end of a local anesthetic injection.

For patients in whom block success was not achieved after 30 minutes: A supplemental dose of bupivacaine was injected or general anaesthesia was induced, and the patient was excluded from data analysis. The duration of postoperative analgesia in all groups was assessed by the time from start of the block to the time of the first analgesic requirement. All groups were observed and assessed for incidence of complications such as pneumothorax (assessed by chest radiography immediately postoperatively and 8 hours later), hematoma or vascular injury (assessed by ultrasound), drug toxicity, hoarseness of voice, neuroaxial block and Horner's syndrome.

Statistical Analysis:

Data were coded and entered using the statistical package SPSS version 21. Data were summarized using mean, standard deviation (SD), median, minimum and maximum for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. Comparisons between groups were done using unpaired t-test in normally distributed quantitative variables while non-parametrical Mann-Whitney test was used for non-normally distributed variables. For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5. P-values less than 0.05 were considered as statistically significant.

3. Results

The addition of dexamethasone to bupivacaine in ultrasound guided SBPB significantly decreased the onset time of sensory block. It was 10.10± 1.60 minutes in group B compared to 13.30±1.93 minutes in group A. Motor block onset was11.86± 1.38 minutes in group B compared to 14.63±1.99 minutes in group A. Also, Prolonged the duration of sensory block. It was13.45± 0.97 hours in group B compared to 8.20± 0.61 hours in group A. Motor block duration was10.66± 0.99hours in group B compared to6.46±0.52 hours in group A. Also, there was a statistically significant increase in the duration of postoperative analgesia. It was31.86± 3.71hours in group B compared to 17.33±3.20 hours in group A.

Table (1): Distribution of the studied patients regarding their demographic data, onset and duration of sensory block, onset and duration of motor block and duration of analgesia (Mean ±SD):

Parameters \ Groups		Group A (n=20)	Group B (n=20)	P value
Age(years)		41.46±9.23	43.20± 9.68	0.080
Weight (kg)		78.66±7.68	76.83± 6.24	0.052
Sex	**Male**	45%	60%	0.732
	Female	55%	40%	
Sensory block	**Onset(min)**	13.30±1.93	10.10± 1.60	0.074
	Duration(hours)	8.20± 0.61	13.45± 0.97	0.001
Motor block	**Onset(min)**	14.63±1.99	11.86± 1.38	0.001
	Duration(hours)	6.46± 0.52	10.66± 0.99	0.01
Duration of analgesia(hours)		17.33±3.20	31.86± 3.71	0.001

4. Discussion

The results of the present study showed that dexamethasone led to a significant enhancement of onset and duration of both sensory and motor block of bupivacaine. Also, dexamethasone improved the quality and prolonged the duration of postoperative analgesia. In agreement with the present study, **Islam *et al* (2011)** used a 35 ml mixture of equal volumes of lignocaine 2% and bupivacaine 0.5% in one group and the same amount of local anesthetics mixed with dexamethasone (8 mg) in the other group for SBPB for forearm surgeries. Their results were in agreement with those of the current study in enhancement of onset of sensory block by dexamethasone. The onset time in their study was slightly shorter than the current study because they mixed bupivacaine with lidocaine, which has a rapid onset of action. In agreement with those of the current study, **Dar and Najar (2013)** injected 30 ml of 0.5% ropivacaine+2 ml saline in one group and 30 ml of 0.5% ropivacaine+2 ml dexamethasone (8 mg) in the other group. They reported that the duration of sensory block was longer when dexamethasone was added to bupivacaine, whereas it was shorter when plain bupivacaine was used in the block.

Shaikh *et al* (2013) reported that the duration of motor block was significantly longer in the dexamethasone group compared with the other group. In agreement with those of the current study, **Cummings (2011)** added dexamethasone to 30 ml of ropivacaine 0.5% or 30 ml of bupivacaine 0.5% in patients who received ultrasound-guided interscalene brachial plexus blockade. Their results were in agreement with those of the present study as they showed that dexamethasone significantly prolonged the duration of analgesia of both ropivacaine and bupivacaine groups after an ultrasound-guided interscalene brachial plexus block. There were no serious complications in contrast to the present study**;** **Islam *et al* (2011)** reported a 40% incidence of Horner syndrome in the dexamethasone group, and 33% in the other group. **Masoud *et al* (2007)** reported that 25% of patients developed vascular injury and 8.8% of patients developed hematoma at the site of injection. This very high incidence of traumatic complication compared with the present study clearly shows the advantage of the use of ultrasound in a SBPB.

5. Conclusion

Addition of dexamethasone to bupivacaine in ultrasound-guided SBPB significantly decreased the onset time and prolonged the duration of sensory and motor blockade. Also, it prolonged the duration and improved the quality of postoperative analgesia in patients who underwent forearm and hand surgeries, with a very low incidence of complications.

References

1. Albrecht E, Kern C and Kirkham KR (2015): A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. Europe PMC., 70:71-83.
2. Awad IT and Chan V (2005): Ultrasound imaging of peripheral nerves, a need for a new trend. Reg Anesth Pain Med., 30:321–323.
3. Choi S, Rodseth R and McCarteney CJ (2014): Effect of dexamethasone as a local anesthetics adjuvant for brachial plexus block. A systemic review and meta-analysis of randomized trial. Br J Anesth, 112:427-439.
4. Cummings and KC (2011): Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth, 14:1-8.
5. Dar, FA and Najar MR (2013): Effect of addition of dexamethasone to ropivacaine in supraclavicular brachial plexus block. Indian J Pain., 27:165–169.

6. Iohom G, MachmachiA, Diarra DP, Khatouf M, Boileau S and Dap F (2005): The effects of clonidine added to mepivacaine for paronychia surgery under axillary brachial plexus block. Anesth Analg., 100:1179–1183.
7. Islam S, Hossain M and Maruf A (2011): Effect of addition of dexamethasone to local anesthetics in supraclavicular brachial plexus block. J Armed Forces Med Coll Bangladesh., 7:11–14.
8. Marhofer P, Sitzwohl C, Greher M andKapral S (2004). Ultrasound guidance for infraclavicular brachial plexus anaesthesia in children. Anesthesia. 59:642–646.
9. Masoud Ng, Taghi MM and Reza Mg (2007): Complications of supraclavicular block of brachial plexus using compound classic and perivascular techniques. Rawal Med J., 32:60–62.
10. Myeong Jong lee, Daejeong Koo, Yu Sun Choi, Kyu Chang lee and Hye Young kim (2016): Dexamethasone or dexmedetomidine as local anesthetic adjuvant for ultrasound -guided axillary brachial plexus block with nerve stimulation. Korean Journal of Pain, 1:29-33.
11. Neal JM and Gerancher J (2002): Brachial plexus anesthesia: Essentials of our current understanding. Reg Anesth Pain Med., 27:402–428.
12. Shaikh, MR, Majumdar S and Das A (2013): Role of dexamethasone in supraclavicular brachial plexus block. IOSR J Dent Med Sci., 12:1–7.
13. Singh A, Gupta R, Vashisth M, Singh S, Kumari A and Aujla KS (2010): Comparison of effectiveness of brachial plexus block by supraclavicular and axillary approach alone or in combination. J Anaesth Clin Pharmacol., 26:31–34.
14. Vieira PA, Pulai I, Tsao GC, Manikantan P, Keller B and Connelly NR (2010): Dexamethasone with bupivacaine increases duration of analgesia ultrasound-guided interscalene brachial plexus blockade. Eur J Anaesthesiol., 27:285–288.
15. Wakhlo R, Raina A, Gupta SD and Lahori VU (2009): 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., 25:17–20.
16. Ya Deau JT, LaSala VR and Paroli L (2008): Clonidine and analgesic duration after popliteal fossa nerve blockade. A randomized double-blind, placebo-controlled study. AnesthAnalg., 1916-1920.
17. Ya Deau JT, Wukovits BU and Lasala (2007): Similar analgesic effect after popliteal fossa nerve blockade with 0.375% bupivacaine and 0.75% bupivacaine. HSS J., 3:1.

12/13/2016