A COMPARISION BETWEEN DEXAMETHASONE AND FENTANYL AS AN ADJUVANT TO LIDOCAINE IN INFRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

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Abstract

Background: Different additives such as opioids and steroids have been used to prolong analgesic effect of local anesthetics. We aimed to compare the efficacy of dexamethasone and fentanyl as an adjuvant to lidocaine in infraclavicular brachial plexus block.

Methods: In this prospective; randomized, clinical trial, eighty one patients 20-60 years old with American Society of Anesthesiologists (ASA) class I and II undergoing elective hand and forearm surgery under infraclavicular brachial plexus block were included in the study. Patients were randomly allocated to receive either 40 ml 1% lidocaine with 2 ml distilled water (Group L, n=27), 40 ml 1%lidocaine with 2 ml (8mg) dexamethasone (Group LD, n=27), or 40 ml1% lidocaine with 2 ml (100µg) fentanyl (Group LF, n=27). The onset time and duration of sensory and motor block and Visual Analogue Scale (VAS) at the time of return of sensation were evaluated and recorded.

Results: When added to Lidocaine, dexamethasone or fentanyl prolonged the duration of sensory and motor blocks and more than lidocaine alone. The onset times of sensory and motor blocks were similar in the studied groups. **Conclusion:** Addition of dexamethasone or fentanyl to lidocaine in infraclavicular block significantly prolonged the duration of sensory and motor block and reduced VAS scores**.**

Keywords: Brachial plexus block, Dexamethasone**,** Fentanyl, Infraclavicular, Lidocaine.

Introduction

Pain, after orthopedic surgeries, can be intense[1] and associated with neuroendocrine response, catecholamine release, and increased morbidity. Central sensitization is believed to be among the mechanisms implicated in the persistence of postoperative pain. Regional techniques have been suggested to produce better analgesia compared to systemic opioids, may improve outcomes, and decrease the adverse side effects of narcotics, and increase the degree of patient's satisfaction[2]. Infraclavicular block can provide analgesia for the upper extremity and is considered a good approach for analgesia below the elbow. It blocks the brachial plexus below the level of clavicle[3]. Prolonging the duration of sensory and motor block of regional anesthetic techniques

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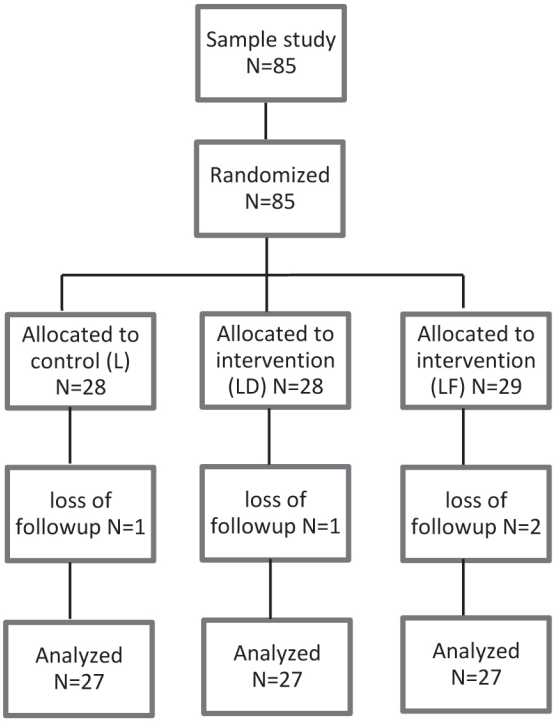
is often desirable. This provides adequate anesthesia for prolonged surgeries and produces pain relief in the immediate postoperative period[4]. Investigators have tried various mixtures of local anesthetics with adjuvant drugs in an attempt to prolong analgesia from nerve block[5].Various adjuvants used to prolong the duration of regional blocks included corticosteroids[4]. Steroids induce a degree of vasoconstriction and act by reducing local anesthetic absorption. A more attractive theory is that dexamethasone increases the activity of inhibitory potassium channels on nociceptive C-fibers (via glucocorticoid receptors), thus decreasing their activity[6,7]. Some clinical studies have shown that addition of opioids to local anesthetics injected to brachial plexus increases the success rate and prolongs the duration of block and improves postoperative analgesia[8].

The aim of this randomization clinical trial is to compare the efficacy of dexamethasone versus fentanyl as adjuvants to lidocaine on infraclavicular brachial plexus block characteristics (onset time and duration of sensory and motor block) and postoperative analgesia.

Materials and Methods

After the approval by the Ethics Committee of Qazvin University of Medical Sciences and obtaining written informed patient consents, eighty-one patients 20-60 years old with ASA class I and II undergoing elective hand and forearm surgery under infraclavicular brachial plexus block were included in the study. The recommendations of Consolidated Standards of Reporting Trials (CONSORT) for reporting the randomized, controlled clinical trials were followed (Figure 1). Patients with any history of allergy to local anesthetics, peripheral vascular disease, coagulopathy, infection at site of injection, neuropathy and pregnant patients were excluded from the study. Patients were randomly allocated to receive either 40 ml 1% lidocaine with 2 ml distilled water (Group L, control group, n=27), 40 ml 1% lidocaine with 2 ml (8mg) dexamethasone (Group LD, intervention group, n=27), or 40 ml 1% lidocaine with 2 ml (100µg) fentanyl (Group LF, intervention group, n=27). Intraoperative standard monitoring including electrocardiogram, pulse oximetry and noninvasive blood pressure monitoring were applied and oxygen was delivered via facemask at a rate of 5 lit/min. Intravenous access was secured with 18-G cannula on the contralateral hand and 2 mg midazolam was administered to all patients as a premedication. Patients were placed in supine position with 90 degree abducted arm. Our landmark was the point 2 cm inferior and 2 cm medial to the coracoid process. This point was cleaned and infiltrated with 1% lidocaine (2 ml). A 10 cm, 21-G insulated needle applied to a nerve stimulator was then inserted at a 45 degree angle to the skin. The nerve stimulator was initially set to deliver a current of 1.0 mA. After electrical stimulation of the cord and production of a visible local twitch, the current was gradually reduced to 0.3 mA or less, and the needle was slowly inserted until muscle activity resumed and finally local anesthetic was injected at that site. Patients were monitored for any complication during the block procedure and surgery.

Fig. 1
CONSORT flow diagram



The onset of sensory and motor block was evaluated by the pinprick and gripping force at 30 seconds intervals. The time of onset of sensory

Table 1
Demographic data for three study groups

	Group L (n=27)	Group LD (n=27)	GroupLF (n=27)	p-value
Age (years)	40 ± 14.39	39.11 ± 12.02	42.11 ± 12.95	0.705
Gender (M/F)	14/13	12/15	20/7	0.073
Duration of surgery(min)	56.11 ± 22.28	56.48 ± 21.29	56.11 ± 19.82	0.998

Values are presented as mean ± SD. L: lidocaine; LD: lidocaine with dexamethasone; LF: lidocaine with fentanyl.

block was defined as the interval between the end of injection and loss of pain in pinprick test around the injury[2]. The duration of sensory block was defined as the time interval between the end of local anesthetic injection and the complete recovery of sensory block[9]. The duration of motor block was defined as the time interval between the local anesthetic injection and complete resolution of motor function[4].The intensity of pain was assessed using the VAS (0= no pain, 10= the most intense pain) .Patients were evaluated at 15, 30, 60 minutes, and at every 30 minutes thereafter until complete recovery of sensory and motor block.

Power of analysis: By using the formula for calculating the sample size in quantitative groups, taking into account the first type error of 5% and the power of 80%, the sample size was calculated in each group of 28 people. It should be noted that the acceptable difference in the groups is considered 15%.

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2 \left(\sigma_1^2 + \sigma_2^2\right)}{\left(\mu_1 - \mu_2\right)^2}$$

Assignment of patients into three groups was implemented using block randomization. The Kolmogorov –Simonov test was used to check for data normality. ANOVA test was used for comparison of quantitative data among the three groups. Qualitative data was compared with Chi-square test. Results were presented as mean ± SD, numbers, ranges and percentages. P value <0.05 was considered statistically significant.

Results

Patients' demographics and duration of surgery were similar among the three groups (Table1).

There were no significant differences in the onset time of sensory and motor block among the three groups (Table 2).

Table 2
Onset time of sensory and motor block in the three groups (mean ± SD)

Groups	GroupL (n=27)	Group LD (n=27)	GroupLF (n=27)	p-value
Onset time of sensory block (min)	4.32 ± 0.83	4.18 ± 0.98	4.29 ± 0.29	0.803
Onset time of motor block (min)	6.11 ± 0.78	5.62 ± 1.13	5.79 ± 0.84	0.173

Values are presented as mean ± SD. L: lidocaine; LD: lidocaine with dexamethasone; LF: lidocaine with fentanyl.

The durations of sensory block in Groups LD and LF were longer than Group L with no significant differences between Group LD and LF. In addition, the durations of motor block in Group LD and LF were longer than Group L with no significant difference between Group LD and LF (Table 3).

The VAS scores in Group LD and LF were lower than Group L with no significant difference between Group LD and LF (Table 4). No significant complication such as pneumothorax, respiratory distress, Horner's syndrome and vascular puncture were observed in any of the groups.

Table 3
Duration of sensory and motor block in the three groups (mean ± SD)

	Group L (n=27)	Group LD (n=27)	Group LF (n=27)	p-value
Duration of sensory block (min)	105.70 ± 9.27	190.1 ± 16.08*	182.22 ± 12.03*	< 0.001
Duration of motor block (min)	125.93 ± 9.71	200.00 ± 11.18*	195.56 + 9.54*	< 0.01

* p <0.05 vs. Group L
Values are presented as mean ± SD. L: lidocaine; LD: lidocaine with dexamethasone; LF: lidocaine with fentanyl.

Table 4
VAS score in the three groups

	GroupL (n=27)	Group LD (n=27)	Group LF P-value (n=27)
VAS score(at the time of return sensation)	7.64 ± 1.46	5.92 ± 0.742	5.53 ± 1.76 < 0.001

* p <0.05 vs. Group L
Values are presented as mean ± SD. L: lidocaine; LD: lidocaine with dexamethasone; LF: lidocaine with fentanyl.

Discussion

In the current study, we demonstrated that addition of dexamethasone or fentanyl to lidocaine in infraclavicular block prolonged significantly the duration of sensory and motor block and reduced VAS score at the time of return sensation, with no significant effect on onset time of sensory and motor block.

Our findings are generally consistent with previous studies, but direct comparision is difficult and controversial results may be due to the differences in methodology, population variation, the variety of local anesthetic mixtures used, and different methods of evaluating block duration.

Several studies reported statistically significant prolonged analgesia with the addition of perineural dexamethasone[10-18]. In the study of Seddik addition of dexamethasone to local anesthetic in infraclavicular block leads to significantly shorter latency time with prolonged postoperative analgesia[19].

It is probable that prolongation of block using local anesthetics and dexamethasone is because of its systemic effect[20,21]. However the accurate mechanism of prolongation of sensory and motor block with dexamethasone seems not to well understood. It is commonly attributed to steroid anti-inflammatory effect[22].

Several studies have attempted to determine whether the addition of opioids to local anesthetics would improve efficacy of peripheral nerve block[10,11]. Some of the possible mechanisms for improvement of analgesia produced by the peripheral application of fentanyl are that fentanyl could act directly on the peripheral nervous system and that fentanyl may potentiate local anesthetic action via central opioid receptor mediated analgesia by peripheral uptake of fentanyl to systemic circulation[23].

Prolongation of sensory and motor block durations observed is consistent with that observed by Movafegh et al which found that the addition of dexamethasone to lidocaine in axillary block prolongs the duration of sensory and motor block[11]. Similarly, Vieira and coworkers showed that adding dexamethasone to bupivacaine in interscalene block increases the duration of analgesia[16]. Another study reported that addition of dexamethasone to supraclavicular block prolongs the duration of analgesia[24].Yaghoobi et al studied postoperative analgesic effect of dexamethasone and fentanyl added to lidocaine in axillary block and reported that the durations of sensory and motor block were significantly longer in lidocaine + fentanyl group compared to other groups[2].

Our study is limited in the sense that we did not use an ultrasound during the block and we did

not conduct a postoperative evaluation of analgesic consumption as well as a survey of patients and surgeons satisfaction.

In conclusion, the addition of dexamethasone or fentanyl to lidocaine in infraclavicular block significantly prolongs the duration of sensory and motor block and reduces VAS scores. Further larger prospective trials are required to evaluate the role of dexamethasone and fentanyl as an adjuvant to lidocaine in the infraclavicular block.

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Compliance with Ethics guidelines: Authors declare that they have no conflict of interest. This manuscript was approved by the Ethics Committee of Qazvin University of Medical Sciences and written informed patient consent was obtained from all patients.

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