COMPARATIVE STUDY OF ONSET AND DURATION OF ACTION OF 0.5% BUPIVACAINE AND A MIXTURE OF 0.5% BUPIVACAINE AND 2% LIDOCAINE FOR EPIDURAL ANESTHESIA

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Abstract- Local anesthetic solutions are frequently mixed to take advantage of the useful properties of each drug but the medical literature is surprisingly deficient in well controlled studies about the onset and duration of action of these mixtures for epidural anesthesia. A total of 32 patients scheduled for elective operation were enrolled in this prospective randomized controlled study; in group I, 16 patients received 15 ml solution containing bupivacaine 0.5% and lidocaine 2% as a single injection epidural anesthesia after 3 ml test dose containing 15 mcg epinephrine; in group II, 16 patients received 15 ml bupivacaine 0.5% with the same technique. The times from injection of the test dose to the onset of sensory anesthesia at inguinal ligament and umbilicus and the time of termination of anesthesia at the maximum sensory level and two levels regression of anesthesia level were checked with pinprick test. The results were compared with two sample *t* test. Times to onset of sensory block in L1 and T10 levels (mean±SD) were 14.87±3.1 min and 21±3.37 min in group I and 17.12±2.18 min and 24.9±2.54 min in group II, respectively ($P< 0.025$ and $P< 0.001$, respectively). Times to termination of sensory anesthesia at the maximum level of anesthesia and two dermatomes regression were 75.12±8.26 min and 87.8±7.01 min in group I and 116.37±22.4 min and 134.87±21.64 min in group II, respectively ($P= 0$ and $P=0$, respectively). Mixing lidocaine 2% with bupivacaine 0.5% in a 1:1 ratio compared to 0.5% bupivacaine solution results in significantly more rapid initiation and termination of sensory block.
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Key words: Mixture of bupivacaine and lidocaine, epidural anesthesia

INTRODUCTION

Used alone, bupivacaine has acquired a reputation for slow onset. Hence, in a busy operating schedule, it would seem attractive to use an agent having the characteristics of fast onset while still retaining the desirable long duration of action of bupivacaine. Consequently, there has been an interest in mixture of local anesthetics.

Animal studies have indicated that it may be possible to retain the favorable properties of each component of such mixtures (1). Previous clinical studies of mixture of local anesthetic agents have produced inconsistent findings (2-4). The clinical advantages of mixing local anesthetics for epidural blockade have not been demonstrated clearly and in two controlled, retrospective clinical trials, drugs such as sodium bicarbonate or epinephrine were also added to the epidural solution (5,6).

The present study provides an objective clinical examination of usefulness of combining plain bupivacaine and lidocaine for epidural anesthesia.

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MATERIALS AND METHODS

After approval by local research ethics committee, 32 patients scheduled for elective lower abdominal and lower extremities operations such as open prostatectomy, inguinal hernia, orthopedic surgery, *etc*. with no contraindication for epidural anesthesia were enrolled in this prospective randomized clinical trial. All patients with a history of coagulation disorder, history of drug abuse and psychological problems, uncooperative patients and who refused to receive regional anesthesia were excluded from the study.

The setting was teaching hospitals of Shiraz University of Medical Sciences from July 2001 to September 2002.

The patients were randomly allocated to two groups: group I, consisted of 16 patients who received l8 ml solution containing bupivacaine 0.5% and lidocaine 2% in a 1: 1 ratio as a single shot epidural injection in L4-L5 inter-space in either sitting or lateral position with a Tuohy needle, size 17 or 18. The first 3 ml of the solution contained 15 mcg epinephrine (test dose) separated from the main dose (15 ml), injected after 3 minutes to rule out intravascular or subarachnoid injection.

Group II consisted of 16 patients who received a total of 18 ml plain 0.5% bupivacaine with the same technique (including 15 mg epinephrine for 3 ml test dose). The times from injection of the test dose to the onset of sensory anesthesia at inguinal ligament (L1) and umbilicus (T10) were recorded. Also, the times of termination of anesthesia in the maximum sensory level and two levels regression of anesthesia were checked with pinprick test.

A 22-gauge needle, extending 2 mm out of its cap was used to check sensory level. Any need to intravenous sedation or analgesia was recorded.

The results were compared with two sample *t* test and Mann-Whitney test with SPSS software. $P<0.05$ was considered statistically significant.

RESULTS

Mean of age in group I was 58.8 years and 54 years in group II ($P>0.05$). The males comprised 68.8% of group I and 43.8% of group II patients ($P>0.05$).

Times to onset and termination of anesthesia in two groups are shown in table 1.

Times to onset of sensory block in Ll (mean±SD) were 14.87±3.1 minutes in group I and l7.12±2.18 minutes in group II ($P=0.025$).

Time to onset of sensory block in T10 was 2l±3.37 minutes in group I and 24.9±2.54 minutes in group II ($P=0.001$).

Time of termination of sensory anesthesia in the maximum level of anesthesia was 75.12±8.26 minutes in group I and l16.37±22.47 minutes in group II ($P= 0$).

Time to termination of sensory block in 2 dermatomes lower than the maximum level was 87.81±7.0l minutes in group I and 134.87±21.64 minutes in group II ($P= 0$).

There was no significant difference in proportion of patients in the two groups who need IV sedation (midazolam 1-2 mg IV), 50% in group I compared to 68.8% in group II ($P=0.28$).

Table1. Times to onset and termination of anesthesia in two groups*

Times to onset and termination of anesthesia	Group I†	Group II‡	*P* value
Onset of anesthesia at L1 (min)	14.87±3.1	17.12±2.18	0.025
Onset of anesthesia at T10 (min)	21±3.37	24.9±2.54	0.001
Termination of anesthesia at the maximum level (min)	75.12±8.26	116.37±22.47	0
Termination of anesthesia at 2 levels lower than maximum level (min)	67.81±7.01	134.87±21.64	0

*Data are given as mean (±SD).

† received l8 ml solution containing bupivacaine 0.5% and lidocaine 2% in a 1: 1 ratio.

‡received a total of 18 ml plain 0.5% bupivacaine.

DISCUSSION

There was no significant difference in age of the two groups. Times to onset of L1 and T10 sensory anesthesia was significantly less in group I than in group II. This is not in agreement with an analogous study of epidural anesthesia using rapid injection of different ratios of commercially available epinephrine-containing solutions of lidocaine and bupivacaine (5). This phenomenon may be due to difference of pH exerted by mixing epinephrine with local anesthetics which may nullify their individual characteristics. In that study the pH of the lidocaine and bupivacaine solutions were between 3.6-3.9 but in our study the pH of 2% lidocaine HCL solution, 5% bupivacaine solution and a 1:1 ration mixture of the two solutions were 5.94, 5.91 and 5.90. Therefore, higher pH of local anesthetic solutions in our study makes non-ionized fraction of the drugs more available, so clinically more rapid onset of action of sensory block in our study.

Termination of anesthesia at the maximum level and 2 dermatomes lower than it was significantly more rapid in group one. This is consistent with results of Cohen *et al.* study (7). One hypothesis is competition of local anesthetics for their receptors when used simultaneously so revealing shorter duration of action of the local anesthetic with more rapid onset of action. On the contrary, Cunningham and Kaplan found that time to termination of action of chloroprocaine and bupivacaine mixture was equal with bupivacaine alone (2). This may be due to a different mechanism of competitive inhibition between ester and amide local anesthetics.

In conclusion, in spite of some previous investigations, it may be concluded that mixing plain lidocaine 2% and bupivacaine 0.5% in equal amounts results in more rapid onset and termination of action of the single-shot epidural block when compared with plain bupivacaine 0.5% alone.

To prove any clinical advantage of this practice, it is advised to compare the onset, duration of action and quality of sensory and motor block of this mixture with plain lidocaine and similar local anesthetics such as mepivacaine.

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