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COMPARISON OF THE ANALGESIC EFFECTS OF A MIXTURE OF LIDOCAINE AND EPINEPHRIN WITH THOSE OF A MIXTURE OF LIDOCAINE AND BICARBONATE FOR LOCAL ANESTHESIA

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Abstract

Study's background and aim: Because pain cautions of tissue damage, humans attempt to find ways to overcome pain.

Lidocaine is one of the most common pharmacological agents used for local anesthesia.

Materials and methods: With regard to the literature evidence, adding epinephrine and bicarbonate to lidocaine further reduces pain and prolongs the analgesia. The aim of the present study was to compare the analgesic effects of a mixture of lidocaine and epinephrine with those of a mixture of lidocaine and bicarbonate for local anesthesia in scalp lacerations. The study was conducted as a double-blinded clinical trial. The sample comprised 92 individuals; the level of anesthesia was determined on the basis of visual analog scale scores.

Results: Pain levels were significantly different at the time of injection, 5 min later and 10 min later. The P value was 0.1 at the time of injection, 0.001 at 5 min after injection and 0.003 at 10 min after injection.

Conclusion: The results indicate that pain levels during the suturing of scalp lacerations are lower while using lidocaine together with epinephrine compared with those while using lidocaine and bicarbonate. This difference is statistically significant.

Keywords: Analgesic effects, lidocaine and epinephrine mixture, lidocaine and bicarbonate mixture, local anesthesia.

1. Introduction: Because pain is undesirable, humans attempt to find ways to overcome pain. Lidocaine is used alone or in combination with other material including epinephrine and bicarbonate for local anesthesia [1-3]. Adjustment of the pH of the local environment helps in controlling the pain while injecting and increasing the duration of anesthesia [4-6].

With regard to the literature evidence, a mixture of epinephrine and lidocaine reduces the speed of absorption and prolongs the analgesic effects [7- 12]. In one study, the analgesic effects of lidocaine used for local anesthesia in during episiotomy incision were studied in comparison with those of a mixture of epinephrine and lidocaine as well as a mixture of bicarbonate and lidocaine. The above-mentioned mixtures did not have a clear impact on the time or intensity of anesthesia [13].

In one study, an epidural anesthetic and lidocaine was compared before and after adding bicarbonate. Adding bicarbonate improved the local anesthetic effect of lidocaine. However, no significant difference was observed when the epidural method was used [14].

In another study, the anesthetic effects of lidocaine and epinephrine were compared with those of pure lidocaine. The results revealed that a mixture of lidocaine and epinephrine significantly increased the duration and extent of anesthesia [15]. The aim of the present study was to investigate the efficiency of a mixture of lidocaine and epinephrine compared with that of a mixture of lidocaine and bicarbonate for local anesthesia in patients of the Imam Khomeini and Golestan health centers in Ahvaz, Iran.

2. Materials and methods

This was a double-blinded study. Patients who visited the Imam Khomeini and Golestan health centers in Ahvaz for suturing of scalp lacerations from March 2013 to March 2014 were considered as the target population. The sample included patients 15–57 years of age who had head injuries with a simple scalp laceration 3–6 cm long and 0.5 cm deep (epidermal and dermal), and who were fully conscious.

Patients with the following conditions were excluded from the sample: decreased level of consciousness; mental retardation; arterial bleeding; lacerations requiring a skin flap; skull fractures and associated injuries; sensitivity to lidocaine, epinephrine, or bicarbonate; contraindications to lidocaine (heart blocks, neurological diseases); contraindications to epinephrine (heart disease, hyperthyroidism, shock, and angle-closure glaucoma); and contraindications to bicarbonate (renal failure, hyperventilation, metabolic or respiratory alkalosis, hypernatremia, and congestive heart failure).

The solutions were prepared and provided to individuals in charge of the project. Patients received one of the two solutions as anesthesia. Neither the individuals in charge of the project nor the patients were aware of the content of

these solutions. The patients were asked to provide pain scores at the time of injection, 5 min after injection, and 10 min after injection.

Pain was measured using visual analog scale scores. A ruler with a scale of 0 to 10 was shown to the patients. They were asked to express their pain using a number from 0 to 10. The doses of medicine used for local anesthesia were as follows: a combination of 0.5 mg lidocaine 2% (Aburaihan Co.) per kilogram with 15 µg epinephrine 0.001% (Darou Pakhsh-Iran Co.) per milliliter; and a combination of 0.5 mg lidocaine 2% per kilogram and 0.05 mg bicarbonate 7.5% (Abidi Co.) per kilogram.

The general outline of this project was assessed by the research ethics community of the Medical University of Ahwaz on November 12, 2012, and were approved with the code Eth-633.

This project was conducted in accordance with the 1974 Declaration of Helsinki. This project was submitted to the Iranian Registry of Clinical Trials (IRCT) database and was registered as IRCT 2014022416711N1. Demographic information was collected. SPSS software (IBM Corporation, USA) was used for statistical analysis of the data.

The two groups were compared using the Mann–Whitney Test. This analysis was performed using K square for qualitative data, frequency, mean, minimums, and maximums using SPSS software version 16. Based on similar research and consultation with statistical experts, the sample included 92 participants who were divided into two groups of 46 individuals.

Ethics considerations: The study procedure was explained to the patients and they provided written consent. The study was conducted in accordance with the beliefs and customs of Iran and did not lead to additional invasive procedures. All data regarding the patients were considered to be confidential.

3. Results

In this study, the population included 95 individuals. Two individuals did not wish to participate in the study and one (receiving lidocaine and bicarbonate) withdrew in the middle of the study. The final sample included 92 individuals.

The pain levels were measured at three different time points, and the interventional effect of age and sex were evaluated. The mean age of the patients was 36 years. The youngest patient was 15 years of age and the oldest was 57 years of age. Sixty-eight (73.9%) patients were male and 24 (26.1%) were female. At all three time points, significant differences were observed regarding the level of reported pain. P values are indicated in the following table.

Table-1. Mean pain levels in the two groups immediately following the injection, 5 min after injection, and 10 min after injection

Mean at different times Pain of different groups	0 min	5 min	10 min
First group	5.6	2.9	1.6
Second group	4.6	2.2	1.2
P value	0.1	0.001	0.003

The first group included individuals who received lidocaine and bicarbonate. The second group included individuals who received lidocaine and epinephrine.

The results indicated that a combination of lidocaine and bicarbonate resulted in a lesser reduction of pain compared with the other mixture.

Table 2. Sex ratio

Sex	Female	Male
n (%)	24 (26.1)	68 (73.9)

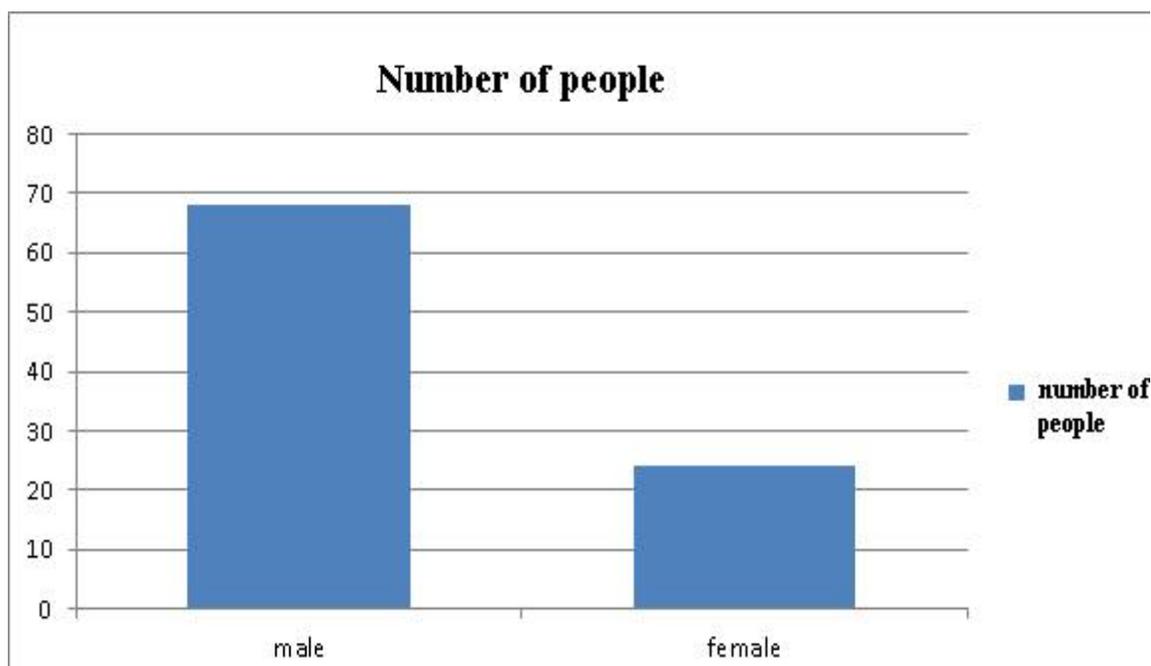


Figure 1. Sex ratio.

As observed, most of the respondents were male [n = 68 (73.9%)].

Table 3. Classification of patients' age.

Age	n (%)
11-20	11 (12)
21-30	28 (30.4)
31-40	32 (32.6)
41-50	18 (19.6)
51-60	3 (3.3)
Total	92 (100)

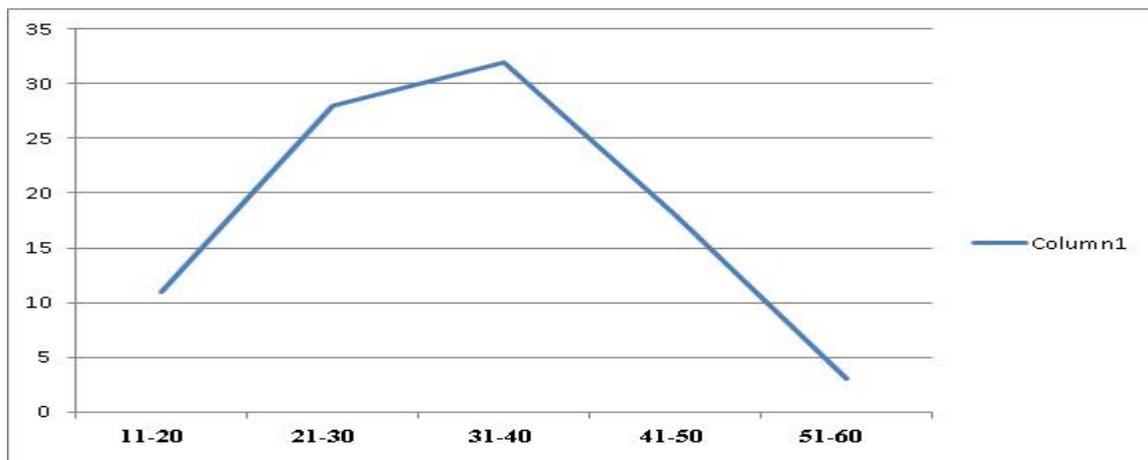


Figure 2. Classification of patients' age.

The age group that included individuals 30–41 years of age (n = 30) had the most amount of participants. The smallest group was the one that included individuals 51–60 years of age (n = 3).

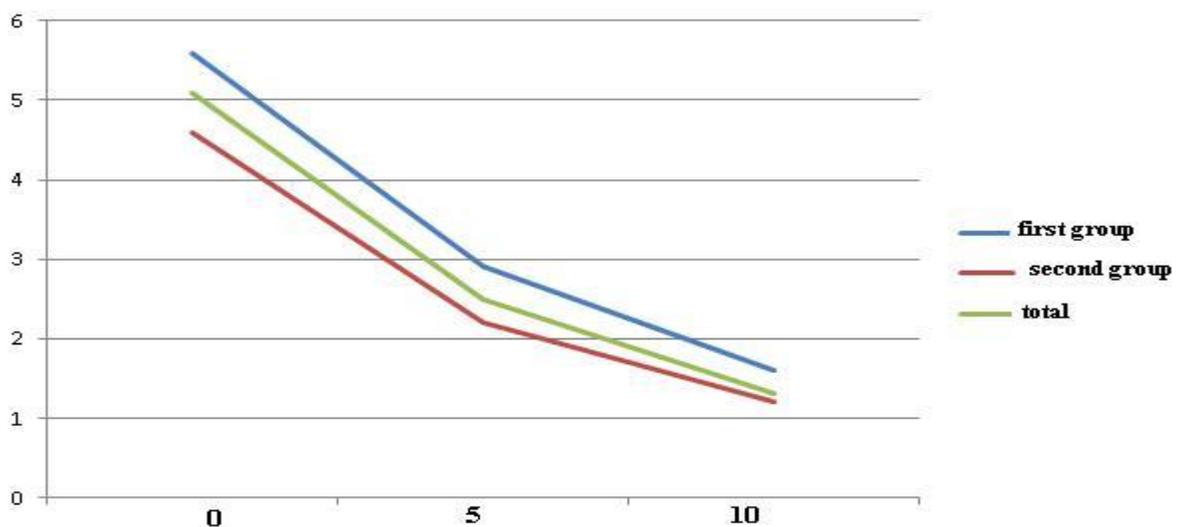


Figure 3. Mean of rank in group 1, group 2, and in the entire group.

The highest pain level was observed in the first group.

The present study was the first in which a mixture of lidocaine and bicarbonate was compared with a mixture of lidocaine and epinephrine applied to a simple scalp laceration. The results indicated that the pain level was lower in scalp laceration suture while using a combination of lidocaine and epinephrine. This difference was statistically significant.

Various studies have been conducted investigating local anesthesia in different parts of the body. In 2012, Welch et al. conducted a double-blinded study regarding local anesthesia of the periauricular region. The pain levels of patients were compared while using a mixture of lidocaine 2% and bicarbonate and while using lidocaine 2% alone. Fifty-four patients were included in the study (mean age 68 years). Injections occurred similarly. The level of anesthesia was evaluated based on visual analog scale scores. The results revealed that the mixture of lidocaine and bicarbonate reduced the pain intensity to a greater extent [16].

Balasco et al. (2013) conducted a double-blinded study in which a mixture of lidocaine and epinephrine was compared with a mixture of lidocaine and bicarbonate for local anesthesia of patients who suffered from pulpal necrosis with acute mastitis. This study included 80 adult patients and pain levels were reported in various stages including injection, placement, drainage, and dissection. In all stages, no statistically significant difference was observed between these two anesthesia methods [17].

Kizer et al. (2014) conducted a study that compared buffered and non-buffered lidocaine during a loop electrosurgical excision procedure. The pain levels at the time of injection and during the surgical procedure were significantly different in these cases [18].

Limitations of the study

A probable problem was that patients did not agree to participate in the study. When they were given sufficient information, almost all patients agreed to participate. Another probable problem was that the data may not have been recorded in some cases.

4. Conclusion

The level of pain was significantly lower ($P = 0.001$) using lidocaine 2% and epinephrine for anesthesia during the suturing of scalp lacerations. This difference was statistically significant.

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