The use of alkalinized bupivacaine for epidural anesthesia at different temperatures

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Eighty patients of groups ASA I and II, having- epidural anesthesia in their operations were investigated in 4 different groups. Group I patients were given a commercially prepared 0.5 % bupivacaine solution plus 0.2 cc 8.4% NaHC03 per 20 cc of bupivacaine at 20°C; (pH: 6.90). Group II patients were given a commercially prepared 0.5 % bupivacaine solution plus 0.2 cc of 8.4 % NaHC03 per 20 cc of bupivacaine at +4° C; (pH: 5,68) Group III patients were given a commercially prepared 0.5 % bupivacaine solution plus 0.2 cc of 8.4 % NaHC03 per 20 cc of bupivacaine at+4° C; (pH: 7.05). Group IV patients were given a commercially prepared 0.5 % bupivacaine solution at +4° C; (pH:5,67)

Times of onset of analgesia and anesthesia in different bupivacaine solutions according to temperature and pH values were investigated. There were no significant effects observed on cardiovascular system. There was no significant difference in motor blockade. There was difference among groups in onset of analgesia and anesthesia. It was concluded that onset of analgesia and anesthesia is more rapid in group III. [Turk J Med Res 1993; 11(6): 277-281]

Key Words: Bupivacaine, Epidural anesthesia.

Bupivacaine is a long acting drug. However, its use is restricted by the late onset of analgesia and anesthesia. Several studies have been performed recently to accelerate its effect and contraversial results have been reported (1,2). In this study, we aimed to shorten the time of onset of bupivacaine anesthesia. For this purpose, epidural anesthesia was made with bupivacain at different temperatures and pH values.

MATERIALS AND METHODS

A total of 80 patients of groups of ASA I and ASA II who received epidural anesthesia in the department of surgery in the Medical School of Ondokuzmayis University were included in this study.

The patients were randomly divided into 4 groups. Each group consisted of 20 patients, and in these groups, of 20 cc of 0,5 % bupivacain with either adjusted or unadjusted pH was administered.

pH adjustment of bupivacaine was prepared as follows: Using an insuline injector 0,2 cc (2mEq) of 98.4 % sodium bicarbonate was added to 20 cc of 0,5 % bupivacaine. This mixture was turned upside down 30 times for 45-60 sec without stirring. pH measurement was made with "Radiometer Kopenhagen-ABL-2, Acide-Base Laboratory, serial num: 276707" (3,4).

The temperature of the local anesthetic was changed by keeping solution either at a temperature of 20° C or in the refrigerator at 4° C.

The patients have been visited the day before the operation and their files were examined. Their permission was asked for the epidural anesthesia. Premedication consisted of 1 mg/kg atropin (i.m.) for patients younger than 50 years; 5 mg haloperidol, 0,015 mg/kg atropin (i.m.) for patients older than 50 years, given 45 minutes before the operation.

A vein of the forearm or hand was canulated by no. 19-20 butterfly set or no. 20-22 intracath. 0,9 % NaCl or 5 % dextrose was infused at a rate of 15 cc/kg/hr. Lumbar puncture was performed at the L3-L4 interspace. If this was not possible, L2-L3 interspace was chosen.

Epidural anesthesia was performed by hanging drop-wise technique. 1,5 mg/kg bupivacaine was administrated to each patient.

The measurements were taken from the moment of exsertion of the epidural needle (o). Time of onset of sensorial loss and anesthesia were determined by a needle preck technique to the throat, abdomen and

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Table 1. Patients'characteristics

Group	n	Agent Used	pH	Mean Age	Mean Weight (kg)	Mean Height (cm)
1	20	20 cc of 0.5 % bupivacaine+2 mEq NaHCO at 20 °C	6.9	46.75±13.94	72.40± 10.06	172.8+5.0
2	20	20 cc of 0.5% bupivacaine at 20 °C	5.68	53.05±11.85	60.05±11.07	170.1+7.1
3	20	20 cc of 0.5% bupivacaine+2 mEq NaHC03 at 4 °C	7.05	51.15t11.70	72.55±9.65	172.0+5.1
4	20	20 cc of 0.5% hi iniv/anainp at *A*	5.67	57.25±10.70	72.00±6.90	171.6±5.1

cc/kg/hr. Lumbar puncture was performed at the L3-L4 interspace. If this was not possible, L2-L3 interspace was chosen.

Epidural anesthesia was performed by hanging drop-wise technique. 1,5 mg/kg bupivacaine was administrated to each patient.

The measurements were taken from the moment of exsertion of the epidural needle (o). Time of onset of sensorial loss and anesthesia were determined by a needle preck technique to the throat, abdomen and lower extremities (5-7). The moment patients were able to feel needle sticks but not distinguish them either as sharp or blunt pain was called the beginning of analgesia, and the moment patients lost the touch feeling was called begining of anesthesia, (for every dermatome) (3,8,9).

This procedure was performed; a) immediately after the block, b) every minute for the first 10 minutes, c) every 2 minutes until the maximum anesthesia level was obtained. Motor blockade was marked at every 5 minutes according to Bromage scale (5).

Blood pressure and heart rate were recorded every 5 minutes on a special form at 0,3,5,10,15,20,30,60 minutes and once every 60 minutes afterwards.

Return of maximal analgesia was considered as the retreat of maximum dermatome level for 2 dermatoms.

After the operation, patients were taken to the recovery room. Level of analgesia was controlled frequently and recorded.

Differences between groups were evaluated by "Student's t test".

RESULTS

Eighty patients administered bupivacaine solutions of different temperature and pH values, were investigated for blood pressure, heart rate, onset of analgesia, onset of surgical anesthesia, onset of motor block, the maximum time of sensory loss, the return time of sensory loss and complications. The results are shown in the figures.

There were no significant differences between the groups with respect to blood pressure and heart rate.

In the first group, onset time of analgesia was between 3 min. and 10 min. with an average of 6.75±2.07 minutes. Onset time of anesthesia was between 6 min. and 18 min. with an average of 11.05±2.30 min. The return time of sensory loss was found between 110 min. and 165 min. with an average of 133.50±12.88 min.

In the second group, onset time of analgesia was between 10 min. and 25 min. with an average of 15.85±3.19 min. Onset time of anesthesia was between 15 min. and 30 min. with an average of 21.15±3.75 min. The return time of sensory loss was found between 110 min. and 150 min. with an average of 132.25±9.93 min.

In the third group, onset time of analgesia was between 1 min. and 8 min. with an average of 3.55±1.57 min. Onset time of anesthesia was between 3 min. and 10 min. with an average of 6.20±1.76 min. The return time of sensory loss was found between 110 min. and 150 min. with an average of 134.75±11.41 min.

In the fourth group, onset time of analgesia was between 5 min. and 20 min. with an average of 13.00±3.82 min. Onset time of analgesia was between 10 min. and 25 min. with an average of 1.50±4.05 min. The return time of sensoryy loss was found between 115 min. and 140 min. with an average of 125.50±6.90 min (Figure 1 and 2).

In the first group, the onset time of motor block was between 15 min. and 50 min; in the second group

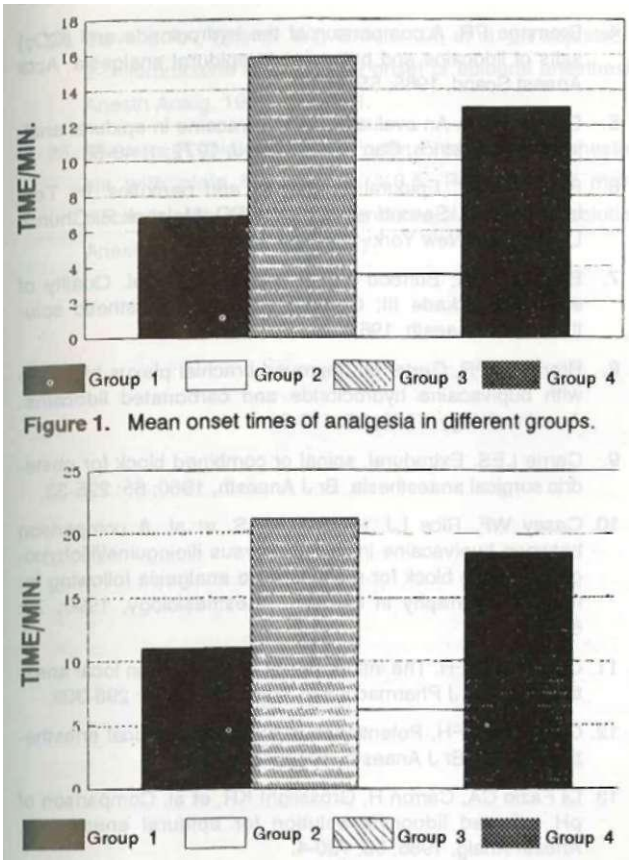

Figure 1. Mean onset times of analgesia in different groups.

Figure 2. Mean onset times of analgesia in different groups.

In the second group, total block developed in two patients (10%), second degree block in two patients (10%), first degree block in six patients (30%) and no block was seen in ten patients (50%).

In the third group, third degree block developed in one patient (5%), second degree block in six patients (30%), first degree blockin six patients (30%) and no motor block developed in seven patients (35%).

In the fourth group, the third degree block developed in two patients (10%), second degree block in two patients (10%), first degree block in eight patients (40%) and no block developed in eight patients (40%) (Figure 3).

DISCUSSION

Addition of epinefrin to a local anesthetic solution decreases its pH. By increasing the pH of local anesthetic solution to physiological levels, it has been reported that onset time of neural blockade was decreased in vitro (2,3,7,13,22,23,28).

The effect of local anaesthetic is augmented by increasing pH as this causes increase in the non-ionised form of the agent. Many factors play role on the speed of analgesia especially during epidural anaesthesia. However, increase of pH is more important on the begining of the effect. Many studies reported by Bromage and other authors about epidural anaesthesia, are informative on the subject.

In order to reduce the onset time of analgesia, many studies have been performed by increasing pH and changing temperature. Different results were obtained.

The onset-time of anesthesia with bupivacaine was found 10.0±1.08 and 28.1 ±1.22 min. respectively by Waters et al (28). In the similar study, the onset time of analgesia and anesthesia was found 4.0±1.2 and 17.7±1.8 mi. respectively by Bledder et all (3). They have also reported that the onset time of analgesia and anesthesia was 3.6±0.9 and 16.3±1.8 min. respectively for pH adjusted bupivacaine. Stevens et al (26) reported similar results for the onset time of analgesia and anesthesia which are 8.8±2.9 and 19.0±6.1 min with bupivacaine; 6.3±1.8 and 12.4±5.1 min with pH adjusted bupivacaine respectively.

In this study, onset times of analgesia and anesthesia were;

In the first group 6.75±2.07 min and 11.05±3.00 min

In the second group 15.85±3.20 min and 21.15±3.75 min

In the third group 3.55±1.57 min and 6.20±1.76 min

In the fourth group 13.00±3.82 min and 18.50±4.05 min. respectively

There were significant differences between groups ($p<0.05$). The fastest onset time was in the third group. In this group, bupivacaine was used at 4° C and high pH. Although our finding were parallel to the findings of Beddee et al. and Stevens et al. However, the time of analgesia and anesthesia was shorter in our study.

The return time of sensory loss was found as 124±8.24 min. with needle prick test by Waters et al (28). The return - time sersory loss was reported as 18.00±12.7 min by Peebles and Slack (19) who used a similar method.

In our study these findings were;

In the first group 133.50±12.18 min,
In the second group 132.25±9.93 min,
In the third group 134.75±11.41 min,
In the fourth group 12.650±6.90 min,

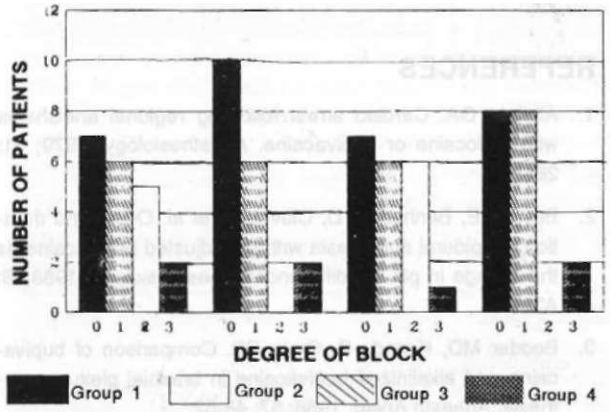

Figure 3. Degree of blockade

There was no significant difference between groups. Our results are consistent with Waters et al.

Henrich Jorgensen (15) performed epidural block on 152 patients and found 48 total block in 25 min. Bromage et al. (using bupivacaine) found 0 degree block in 34 patients, first degree in 13 patients, second degree in 3 patients. By using bupivacaine in this study, third degree motor block has not been reported.

In our study no motor block was seen in 32 patients (40%) second degree block in 26 patients, first degree in 15 patients an third degree block in 7 patients out of 80 patients.

It was concluded that time of analgesia and anesthesia was shorter with alkalinized bupivacaine at low temperatures. Alkalinized bupivacaine at low temperatures (as the long onset times of analgesia and anesthesia are considered disadventageous) is an advantage in epidural anesthesia.

Epidural anestezide alkalinize bupivakain kullanımı

Ameliyatları esnasında epidural anestezi uygulanan ASA I ve II gruplarından 80 hasta 4 ayrı grupta incelendi. Birinci gruptaki hastalara ticari olarak hazıdanmış %0.5 buph/acain+, t 20 °C'da her 20 cc için 0.2 cc %8.4 NaHCÖ3 verildi,çözeltininpH'sı 6.90 idi. 2 gruptaki hastalara ticari olarak hazıdanmış %0.5 bupivakain + ,+4°C'de her 20 cc için 0,2 cc %8,4 NaHCC-3, (pH: 5.68) verildi. 3. gruptaki hastalara ticari olarak hazırlanan %0.5 bupivakain +, +4°C'da her 20 cc için 0,2 cc %8,4 NaHCC-3, (pH: 7.05) verildi. 4. gruptaki hastalara ise +4°C'de %0.5 bupivakain, pH: 5.67, verildi. Farklı ısı ve pH değer/erindeki bupivakain ile aneljezi ve anestezi başlama zamanları araştırıldı. Kardiyovasküler sistem üzerinde önemli bir etkileri yoktu. Motor blok açısından da anlamlı farklılıklar izlenmedi. Gruplar arasında aneljezi ve anestezinin başlangıcı açısından fark vardı. 3. gruptaki hastalarda anestezi ve analjezi başlangıcının daha hızlı olduğu sonucuna varıldı. [TurkjMedRes 1993; 11(6): 277-281]

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