

Title : ONSET AND DURATION OF EPIDURAL ANALGESIA WITH pH-ADJUSTED BUPIVACAINE:
IS THE CHANGE IN pH THE DIFFERENCE ?

Authors : E. Bavoux M.D., D. Benhamou M.D., N. Clavier M.D., N. Perrachon M.D.
T. Labaille M.D.

Affiliation : Département d'anesthésiologie, Université Paris-Sud, Hôpital Antoine Beclère,
157 rue de la Porte de Trivaux 92140 Clamart - FRANCE

INTRODUCTION: Contrary to in vitro studies which have shown that pH-adjustment of local anesthetics may decrease the time to onset of nerve block (1) and increase its duration (2), clinical studies have yielded controversial results: indeed, some authors demonstrated modifications of the dynamics of the block (3, 4) whereas others did not (5). The hypothesis that the clinical controversy may be at least partially related to variable degrees of changes in pH from one study to another was tested.

METHODS: Forty six primipara parturients were studied during the first stage of labor after informed consent was obtained. After rupture of membranes, lumbar epidural anesthesia was performed in the sitting position, the first dose being injected through the Tuohy needle in two fractions of 5 ml each, at a 3 minutes interval. An epidural catheter was then inserted for subsequent injections. The patients were then placed in a semi recumbent position with a small pillow in their back to provide 10 degrees of left lateral position. Patients were randomly assigned to one of three groups, differing on the epidurally drug injected: Group 1 (n = 16): commercial solution of 0.25 % bupivacaine without epinephrine, group 2 (n = 17): solution of 0.25 % bupivacaine without epinephrine which pH had been adjusted with 1.4 % sodium bicarbonate (0.6 ml added to 20 ml of bupivacaine), group 3 (n = 13): solution of 0.25 % bupivacaine without epinephrine which pH had been adjusted with 4.2 % sodium bicarbonate (0.8 ml added to 20 ml bupivacaine). Addition of bicarbonate was performed extemporaneously and pH of each solution was measured in 5 successive bottles with a pHmeter (pHm82 Standard pHmeter, Radiometer Copenhagen, sensitivity 0.01 pH unit) calibrated before each measurement with known solutions of pH 4 and 7. Usual monitoring consisted of repetitive measurements of maternal heart rate and blood pressure with an automatic device and a continuous recording of fetal heart rate. Time to onset (first painless contraction) and duration of the sensory block (time to request for reinjection) were defined as starting at the end of the first injection and compared between groups. Data are expressed as mean \pm SD and were compared by using ANOVA followed by Neuman-Keuls test when necessary. A p value of less than 0.05 was considered significant.

RESULTS: Patients were comparable between groups as regard to age, weight, and height. The mean pH of the commercial solution of 0.25 % bupivacaine was 5.42 ± 0.03 whereas for alkalized solutions, pH was respectively 7.01 ± 0.02 (group 2) and 7.36 ± 0.03 (group 3). The time to onset of analgesia was significantly reduced with either pH-adjusted mixture (4.6 ± 2.1 min and 6.2 ± 2.0 min for respectively

group 2 and 3) as compared with the effect of the commercial bupivacaine (8.3 ± 4.1 min). However, there was no difference in the time to onset between the two groups receiving alkalized bupivacaine. The duration of analgesia was significantly and linearly related to the change in pH: the higher the pH, the longer the duration of one dose.

DISCUSSION: In a well defined situation (patients, technique of regional anesthesia and concentration of bupivacaine), the results of this study are in agreement with our theoretical background and with in vitro studies (2, 3) showing that onset and duration of a nerve block are correlated to the fraction of unionized lipophilic drug. We conclude that provided a sufficient increase in pH is obtained, the increased duration of analgesia after addition of bicarbonate may help in the clinical setting to reduce the total dose of bupivacaine administered.

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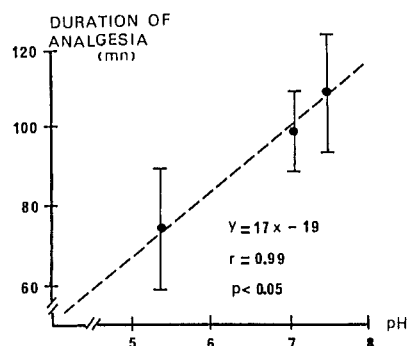


Figure. Correlation between duration of analgesia and changes in pH of 0.25% bupivacaine.