Title : BUPIVACAINE BLOOD LEVELS FOLLOWING SCALP INJECTION

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Introduction. Scalp infiltration of local anesthetic during epilepsy surgery results in the appearance of drug in the systemic circulation.[1] If local anesthetic concentration in the blood reaches appropriate levels, its anticonvulsant action may interfere with localization of the seizure focus. On the other hand, if the blood level goes even higher, the convulsant action of the local anesthetic may come to the fore. Despite these unwanted effects, data about the systemic accumulation of local anesthetic during epilepsy surgery are lacking. In this report, we present arterial blood levels of bupivacaine following subcutaneous scalp infiltration of 0.125% and 0.25% solution (both in epinephrine 1:400,000) in patients undergoing awake craniotomy for excision of a seizure focus.

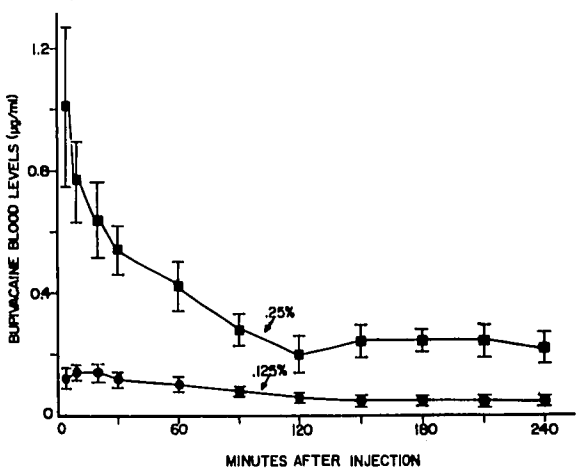
Methods. Eleven patients were studied. In the operating room, a venous and radial artery catheter were placed with the arterial line used to continuously monitor blood pressure and to sample blood for bupivacaine analysis. Continuous EKG monitoring was also done throughout the procedure. Each patient was sedated preoperatively with 1-2 ml of either iv fentanyl-droperidol or fentanyl alone. The scalp of six patients (Group 1) was infiltrated with a solution containing bupivacaine 0.125% and epinephrine 1:400,000. In the other five patients (Group 2) 0.25% bupivacaine and 1:400,000 epinephrine were used. The initial injection volumes were determined by the magnitude of the craniotomy incision. Blood samples for bupivacaine assay were drawn at 5, 10, 20, and 30 minutes and then at 30 minute intervals up to four hours following the initial injection. Bupivacaine assays were done using a gas/liquid chromatograph.

Results. (See Figure). There was no statistically significant difference between the initial injection volumes used in the two groups (41±14 cc of 0.125% vs. 40±9 cc of 0.25%) (mean values ±SD). Supplemental injections of 22±10 cc of 0.125% were given during the initial 240 minute period whereas supplemental injections of only 12±7 cc of 0.25% were required. All patients receiving the 0.125% solution of bupivacaine required additional injections during scalp closure; this was not necessary in the patients receiving the 0.25% solution. Peak blood levels of bupivacaine were detected within five to 10 minutes after the initial injection in both groups. In Group 1, the peak blood value was 0.12±6 µg/ml (range 0.06-0.21 µg/ml) and in Group 2, 1.01±0.67 µg/ml (range 0.20-1.71 µg/ml). Peak levels progressively declined up to 120-150 minutes and then fell at a much slower rate. At the time of EEG recording to detect the patients' seizure focus, blood levels averaged 0.05 µg/ml (Group 1) and 0.25 µg/ml (Group 2). In all patients, the seizure focus was successfully located and no grand mal seizures occurred intraoperatively during the time of peak blood levels of bupivacaine.

Discussion. The difference between peak blood levels of bupivacaine in Group 1 and Group 2 patients is much greater than anticipated. We expected that doubling the anesthetic dose would approximately double the arterial bupivacaine level rather than increase it nearly tenfold. No clear-cut explaination for this unexpected result is available. It is possible that saturation of tissue binding sites and/or antagonism of epinephrine-induced vasoconstriction, with subsequent increased local blood flow, might occur when 0.25% but not 0.125% bupivacaine is used. Because fewer supplemental injections of 0.25% bupivacaine were required as compared to when 0.125% solution was used, the higher concentration was judged to provide more satisfactory analgesia. There was no indication that use of the higher concentration resulted in systemic toxicity or impaired detection of the epileptic focus, thus we now routinely use the 0.25% solution for awake craniotomies.

References:

1. Stoelting, R.K.: Plasma lidocaine concentrations following submucosal epinephrine-lidocaine injections. Anesth Analg 57: 724-726, 1979.



Bupivacaine blood concentration after scalp injection mean values ± SE

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