Title: THE MINIMUM EFFECTIVE CONCENTRATION OF BUPIVACAINE FOR CAUDAL ANALGESIA AFTER SURGERY IN PEDIATRICS

Authors: A. Wolf, MB BChir, FFARCS, R.D. Valley, MD, D.W. Fear, MD, FRCPC, W.L. Roy, MD, FRCPC, J. Lerman, MD, FRCPC

Affiliation: Department of Anaesthesia and the Research Institute, The Hospital for Sick Children and the University of Toronto, Toronto, Ontario.

Introduction: The optimal concentration of bupivacaine for caudal analgesia should provide both maximal analgesia and minimal motor blockade.[1] Because motor blockade is not uncommon after caudal blocks with the 0.25% concentration,[2] we speculated that the optimum concentration of bupivacaine may be less than or equal to 0.25%. Therefore, we determined the duration and quality of postoperative analgesia, extent of motor blockade, and associated side effects of three concentrations of bupivacaine: 0.25%, 0.125%, and 0.0625%.

Methods: With approval from the Human Review Committee and informed written parental consent, 97 patients, 6 months to 8 years of age, scheduled for elective lower abdominal or genital surgery underwent a randomized double-blinded study. The patients were all ASA physical status I or II, fasting, and unpremedicated. Anesthesia was induced with thiopental, atropine and succinylcholine and maintained with 70% nitrous oxide, 30% oxygen and halothane. Narcotics were not administered at any time. Local anesthetic was used only for the caudal block.

After completion of surgery but prior to emergence, the patients were randomly assigned to receive one of three concentrations of bupivacaine: 0.25%, 0.125%, or 0.0625% each containing 1:200,000 epinephrine for a caudal block. The volume of solution used was 0.75 ml/kg. After administration of the caudal block, the patients were awakened, transferred to the recovery room for 1-2 hours and then returned to the ward. Codeine (1 mg/kg IM) was administered if the pain score[3] was > 3 and the patient complained of pain.

Pain scores[3] and codeine requirements, motor strength (ranging from paralyzed to able to stand), side effects, and complications were recorded for 12 hours after surgery.

Statistical significance ($p < 0.05$) was determined using ANOVA and the Newman-Keuls test for parametric data, and the Mann Whitney U-test and Chi-square analysis with the Yates correction for non-parametric data.

Results: The three treatment groups were similar for age, weight, and the type of surgery (Table). The duration of postoperative pain relief and codeine requirements were significantly greater with the 0.25% and 0.125% solutions than with the 0.0625% solution within the first 4 hours after surgery ($p < 0.05$). There was no difference in pain relief between the 0.25% and 0.125% solutions at any time. The percent of patients able to stand 1 hour postoperatively differed significantly for the 0.25%, 0.125%, and 0.0625% concentrations: 26% < 53% < 86% respectively ($p < 0.05$). Two children were excluded from the study: one because of an inadvertent subarachnoid puncture and one because of an epidural venous puncture.

Discussion: The optimal concentration of bupivacaine for caudal analgesia after surgery in pediatrics must provide maximal analgesia and minimal motor blockade. The results of the present study indicate that 0.125% bupivacaine satisfies these criteria. Although 0.125% and 0.25% solutions both provide similar analgesia, the former solution causes less motor weakness than the latter. Therefore, the authors recommend 0.125% bupivacaine with 1:200,000 epinephrine for postoperative caudal analgesia in both outpatients and inpatients undergoing lower abdominal or genital surgery.

TABLE

% BUPIVACAINE	0.0625	0.125	0.25
AGE (months)	41.3 ±24.7	42.7 ±24.9	42.5 ±27.2
WT (kgs)	15.1 ±5.6	15.4 ±5.2	15.7 ±4.9
SURGERY:			
LOWER ABD	16	12	17
GENITAL	14	23	15
TOTAL NO. OF PATIENTS	30	35	32

References:

1. Kapsten JE, Broadman LM, Hannallah RS, et al. Can Anaesth Soc J 33:S114, 1986
2. Vater M, Wandless J. Acta Anaesthesiol Scand 29:175-9, 1985
3. Hannallah RS, Broadman LM, Belman AB, et al. Anesthesiology 61:A429, 1984