

Title : ONSET AND RECOVERY OF PERIPHERAL NERVE BLOCKS WITH LOCAL ANESTHETICS IN AN IN VIVO CAT MODEL

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Introduction: Local anesthetics (LA) have been classified clinically as short, medium, or long acting based upon onset time and duration of action.(1) In vitro studies in animal models have not been able to confirm this, since the duration of action is not measurable and the testing conditions are controlled. It is well known that duration of action is dependent not only on the LA, per se, but also on local blood flow, acid-base status, and liver and kidney functions of the animal tested.(2) This study was designed to evaluate four commonly used LA in an in vivo cat model which simulated clinical conditions as much as possible.

Material and Methods: Lidocaine, 2-chloroprocaine, etidocaine, and bupivacaine were studied in 20 healthy cats. Each cat was anesthetized lightly. Anesthesia was induced with 50 mg/kg ketamine (IM) and maintained with 0.1-1.0% MOF, 60% N₂O, and 40% O₂. Ventilation was controlled by a Harvard Model 66-1 respirator via an indwelling endotracheal tube. Catheters were placed in the R common carotid artery and R jugular vein. D₅RL was infused via the intravenous line at the rate of 7ml/kg/hr. Blood pressure, pulse rate, temperature (esophageal), blood gases (P CO₂, P O₂, HCO₃⁻ and pH), and urine output were monitored and recorded continuously or serially. All cats were kept at normal physiological status.

The saphenous nerve was exposed at the groin and placed carefully on the stimulating electrode. 7 cm. distal to the proximal exposure another cut was made over the saphenous nerve in the thigh and was placed on the recording electrode. A 2" 22-gauge B-D spinal needle was placed on the nerve, under the skin, between the two electrodes. The nerve was stimulated at 0.0167 Hz supramaximally. The three nerve fiber action potentials (NFAP) were identified by the following latencies: A_α at 1 msec, A_δ at 5 msec, and C at 60 msec. The NFAP was monitored and recorded by a Polaroid camera on a Tektronix 564B Storage Oscilloscope.

When the NFAP was stable, 0.3 ml of the test LA was injected via the spinal needle. The concentration of each LA chosen was determined by the fact that at least one nerve fiber was blocked completely every time. Changes in NFAP were recorded every minute during onset and every 15 minutes during block and recovery. The onset time was considered as the time for maximum block to occur. The length of block was determined from the time of complete onset to when the recovery just started. The recovery time was determined from the time the LA was injected to the time the block started to recover. %block was determined by decrease in amplitude from time 0. Onset and recovery for each fiber and LA was plotted as a function of time and statistically analyzed employing student's t test and paired t test.

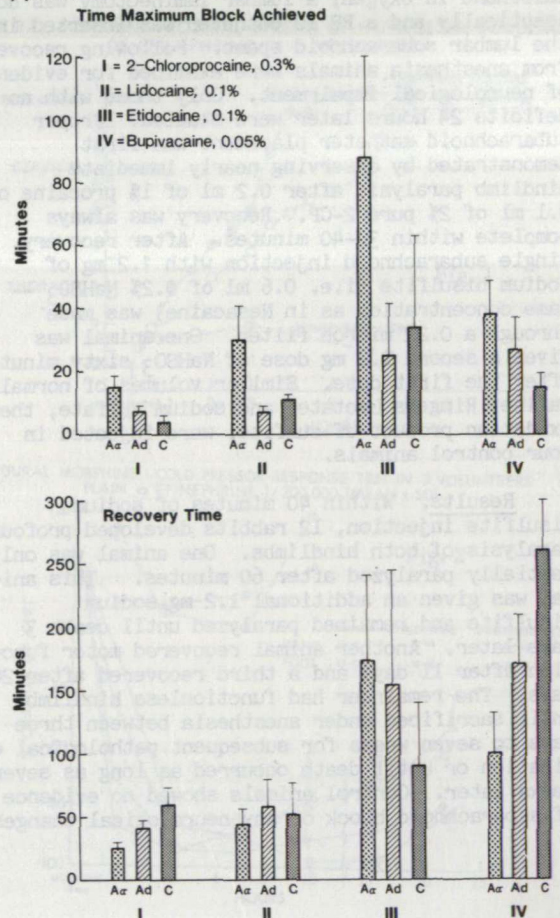
Results: The figure shows onset time (top) and recovery time (bottom) for each nerve fiber type and for each LA. 1) A_α fibers had the longest onset time and C fibers had the shortest onset time with every LA. 2) 2-CP and lidocaine recovered faster than etidocaine and bupivacaine. 3) Etidocaine and bupivacaine differed from each other in the following manner: a) C fiber block was prolonged with bupivacaine whereas it was short with etidocaine, b) Bupivacaine blocked C fibers whereas etidocaine blocked A_α fibers

the longest preferentially, c) During recovery, statistically significant differences were seen with bupivacaine in C and A_α fiber blocking where C fibers were blocked the longest. With etidocaine, a statistically different block was also found with these fibers but, in this case, A_α fibers were blocked the longest.

Discussion: This study demonstrates the usefulness of an in vivo cat model for predicting the clinical effects of local anesthetics for the following reasons: 1) The model preserves the distinction between short and long acting local anesthetics, 2) The prolonged C fiber block seen with bupivacaine in this model correlates with the prolonged pain relief seen clinically, 3) With etidocaine patients, the clinical syndrome of motor weakness with pain correlates with the results obtained in this study.

References:

1. Covino, BG, Vassallo HG: Local anesthetics: Mechanisms of action and clinical use. Grune and Stratton, New York, 1976, p 70.
2. Covino BG, Vassallo HG: Local anesthetics: Mechanisms of action and clinical use. Grune and Stratton, New York, 1976, p 51.



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