

Date :  
 Title : NEUROLOGIC OUTCOME FOLLOWING CARDIAC ARREST IN THIOPENTAL TREATED CATS  
 Authors : H.S. Chadwick, M.D., M.M. Todd, H.M. Shapiro, M.D., B.J. Dunlop, M.D. and L.F. Marshall, M.D.  
 Affiliation: Department of Anesthesia and Neurosurgery, Veteran's Administration Hospital, San Diego, and University of California, San Diego, California 92161

**Introduction.** Barbiturate therapy after global brain ischemia (cardiac arrest) remains controversial, in part due to methodologic problems in previous work. We have reexamined the effects of high-dose thiopental on mortality and neurologic outcome after a 12 min cardiac arrest, using a recently developed cat model of ventricular fibrillation (VF) and closed chest cardiopulmonary resuscitation.

**Methods.** Thirty-three paralyzed, ventilated ( $\text{PaCO}_2=30-35$  torr) cats under 70%  $\text{N}_2\text{O}$  analgesia were subjected to 12 min of electrically induced VF. Monitors included arterial and right atrial pressures, EKG, EEG, blood gases (ABG's),  $\text{FETCO}_2$ , Hct and electrolytes. Resuscitation required ventilation with 100%  $\text{O}_2$ , i.v. epinephrine,  $\text{NaHCO}_3$ ,  $\text{CaCl}_2$ , atropine and lidocaine, plus DC defibrillation and was considered complete when a spontaneous systolic  $\text{BP}>100$  torr was maintained. After resuscitation, cats were randomized into one of 3 groups. To study the role of post-arrest care, Groups I and II received ICU support (ventilation, ET suction, fluids, etc.) for 3 and 22 hrs. respectively. No pressors or other drugs were needed. Group III received 60 mg/kg thiopental starting 5 min post-resuscitation, 25 mg/kg in the first 5 min, the rest over the next 29 min. Mean BP was kept above 100 torr with dopamine, and all Group III cats received 22 hrs ICU care. At the end of the ICU period, cats were weaned and extubated, and lines removed. Nursing care was given for 7 days, and neurologic deficit was scored (NDS) daily, based on level of consciousness, respiration, cranial nerve function, spinal reflexes, behavior and gait. NDS=0 represents a normal cat, and 100 maximal neurologic damage. At 7 days, brains were removed and examined for pathology. Six unarrested cats received thiopental, with 22 hr ICU care.

**Results.** Effective cardiac action stopped immediately after VF. EEG was flat in  $23\pm 6$  (SEM) sec, and pupils were dilated in  $<2$  min. Resuscitation time was  $2.4\pm 0.6$  min., and was the same for all groups. There were no intergroup differences in any monitored variable pre- or post-arrest during the ICU period. NDS is shown in Fig. 1. There were no differences between any arrested groups, with NDS of survivors at 7 days of  $19\pm 4$ (I),  $17\pm 8$ (II), and  $15\pm 6$ (III). The sham and thiopental group (IV) had an NDS of  $1\pm 0.6$  at 7 days. Mortality for the groups (at 7 days) was 3/12(I), 3/11(II), and 1/10(III), again with no statistical

differences. However, of untreated cats (Groups I & II, 10/23 showed high frequency bursts of EEG activity suggestive of seizures, appearing between 30 and 90 min post-arrest, and within this combined subgroup, mortality was 6/10 vs. 0/13 for "seizure free" cats ( $p<.05$ ,  $\chi^2$ ). Mortality, NDS and seizure incidence were identical for Groups I & II. Seizures were never seen in Group III, and while there were fewer deaths compared to other groups, this is not statistically significant ( $p>.05$ ).

**Discussion.** The model described produces a clinically relevant form of brain ischemic damage, avoiding the use of potent anesthetics, hypotensive drugs or complex surgery. While the use of a longer arrest period or many more cats might allow therapy related differences to be resolved, we were unable to show any clear benefit of either prolonged ICU support, or of barbiturate treatment after 12 min arrest. The appearance of EEG "seizures" post-arrest was associated with a poor outcome, but thiopental suppression of seizure activity did not obviously improve survival or NDS. While further work is in progress, we cannot support the clinical application of barbiturate therapy until more laboratory evidence for its value is shown.

Figure 1. The relationship between time following resuscitation from a 12-min arrest and NDS is graphed for all animals surviving 7 days.

