TITLE: THE EFFECTS OF HALOTHANE AND ISOFLURANE ON CEREBRAL BLOOD FLOW AT VARIOUS LEVELS OF $PaCO_2$ IN RABBITS

AUTHORS: M.S. Scheller, M.D., M.M. Todd, M.D. and J.C. Drummond, M.D.*

AFFILIATION: The Department of Anesthesiology (Neuroanesthesia Research, M-004), University of California at San Diego, La Jolla, California 92093

Introduction: Halothane(H) and isoflurane(I) are cerebral vasodilators which can cause dangerous increases in intracranial pressure (ICP) in some patients. However, human data indicates that the cerebrovascular responses to alterations in $PaCO_2$ may differ depending on which agent is selected(1,2). Furthermore, a study in cats demonstrated that cerebral blood flow (CBF) was lower with isoflurane(+75% N_2O) than in N_2O sedated controls during hypocapnia(3). Such data suggest that $PaCO_2$ is an important determinant of the response of the cerebral vasculature to H and I. To better define the effects of these agents on CBF under conditions of altered $PaCO_2$, we have undertaken the following study.

Methods: Rabbits(n=18)were anesthetized with 4% H in O_2. After intubation, H was discontinued and morphine sulfate(MS) 10mg/kg was given IV with 1mg of pancuronium (P) followed by an infusion of 2mg/kg/hr MS and 1mg/kg/hr P. Ventilation was controlled with 70% N_2O in O_2 and monitors were placed after local infiltration of 0.25% bupivicaine. Mean arterial pressure(BP), central venous pressure(CVP),temperature, ICP, end tidal(ET) volatile agent and expired CO_2 were monitored continuously. Platinum electrodes for the measurement of CBF(Hydrogen clearance method) were stereotactically placed in the cortex (cortical),dorsal hippocampus(deep grey) and subcortical white matter(white matter). $PaCO_2$ was altered by adjusting the inspired CO_2. Each animal was studied at 3 levels of $PaCO_2$: Low (20-25), Normal (35-40) and High (50-55mmHg) in a randomized fashion(one agent per animal). Control CBF was determined after target $PaCO_2$ had been maintained for 10 min. H or I was then introduced and maintained at 1 MAC ET concentration for 10 min. before CBF measurements were repeated. Angiotensin II was administered to maintain BP at control levels (± 10mmHg). After CBF measurements were made, volatile agent was omitted with the animal at normocapnia until the ET concentration was < .08% before going to the next $PaCO_2$ level.

Results: BP, CVP, ICP, arterial blood gases and CBF in all 3 areas were similar for both groups at each $PaCO_2$ level before the addition of H or I. Addition of either H or I was associated with increases in CVP and ICP at all levels of $PaCO_2$(paired t test,$p < .05$). With the addition of I, CBF decreased significantly during hypocapnia in all areas. During normocapnia, CBF was unchanged with I, whereas during hypercapnia CBF increased in dorsal hippocampus and white matter but was unchanged in the cortex. CBF increased in all areas at all $PaCO_2$ levels with H(Figure 1).

Discussion: These data indicate that I decreases CBF during hypocapnia in rabbits. By contrast, H increased CBF in all areas at all $PaCO_2$ levels. However, despite CBF changes in opposite directions during hypocapnia, ICP increased with both H and I. Thus, although the CBF effects of these agents suggest that I may be preferable to H in patients with decreased intracranial compliance, the ICP effects of these agents demand further study and continued caution in the use of these agents.

References:

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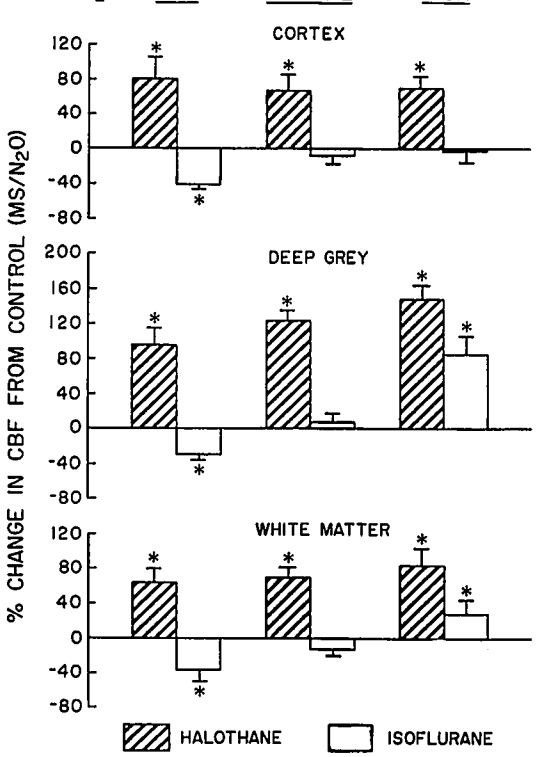
FIGURE 1



* Denotes significant change from control (N_2O/MS) $p < .05$, paired t-test.

* Parker B. Francis Investigator in Anesthesiology