

**TITLE:** DOES ISOFLURANE AFFECT THE CEREBROVASCULAR RESPONSE TO CARBON DIOXIDE IN ANESTHETIZED CHILDREN?

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It has been stated that isoflurane (I) is the inhalational agent of choice in neuroanesthesia because of its lesser cerebral vasodilatory properties.<sup>1</sup> Although this statement has been supported by several adult studies, regional cerebral blood flow (rCBF) investigations have shown an increase in CBF with stepwise increases in I concentrations.<sup>2</sup> In practice one uses hyperventilation to attenuate this increase in CBF during procedures with raised intracranial pressure (ICP). No studies to date have reported the effects of I in varying concentrations on the cerebrovascular reactivity to CO<sub>2</sub> in anesthetized children.

With approval of our Ethics Committee, 15 ASA I and II, fasting and unpremedicated children for elective urological procedures were studied. Anesthesia was induced with thiopentone 5mg/kg, fentanyl 2mcg/kg, and vecuronium 0.1 mg/kg. After the trachea was intubated, anesthesia was maintained with isoflurane, 75% Air in O<sub>2</sub> and vecuronium 0.05mg/kg. All patients received a continuous caudal or lumbar epidural block performed with 0.25% bupivacaine prior to incision. Ventilation was adjusted to achieve an end tidal CO<sub>2</sub> (PE'CO<sub>2</sub>) of 20 mmHg. Fresh gas flows were maintained constant to avoid any variation in intrathoracic pressure. Normothermia was maintained. PE'CO<sub>2</sub> was randomly equilibrated to 20, 40, or 60 mmHg with an exogenous source of CO<sub>2</sub>. Patients were randomized to begin either at 0.5 MAC or 1.0 MAC I. A time interval of five minutes was allowed between CO<sub>2</sub> changes and fifteen minutes was allowed between [I] changes to achieve steady state. SAP, HR, O<sub>2</sub> saturation, end-tidal isoflurane, and inspired O<sub>2</sub> were recorded. Cerebral Blood Flow Velocity (CBFV) and resistance index (RI+) in the Middle Cerebral Artery (MCA) was measured with the TCD. CBFV, RI+, and PE'CO<sub>2</sub> were analyzed using logarithmic regression and r<sup>2</sup> value. Statistical significance (p<0.05) was determined with paired t-test, ANOVA and the SNK test for multiple comparisons.

The mean (±S.D.) age and weight was 39.4 ±27.2 mo and 15.5±6.2 kg. The CBFV increased logarithmically as PE'CO<sub>2</sub> increased during both 0.5 MAC (r<sup>2</sup>=0.99) and 1.0 MAC (r<sup>2</sup>= 0.96) I. The RI+ showed an inverse logarithmic relationship with PE'CO<sub>2</sub> at 0.5 MAC (r<sup>2</sup>= 0.98) and 1.0 MAC (r<sup>2</sup>=0.76) I (fig. 1). However, there was no statistical difference between CBFV at 20, 40, or 60 mmHg CO<sub>2</sub> when comparing 0.5 MAC and 1.0 MAC I (fig. 2). CBFV at 40 and 60 was different than at 20 mmHg (\*= p<0.05) and CBFV at 60 was different than at 40 mmHg (+=p<0.05) (fig 2). HR, SAP, temp, and O<sub>2</sub> saturation did not change significantly during the study.

We showed that I does not affect cerebrovascular carbon dioxide reactivity. Recently, it has been suggested that there is an intrinsic effect of I anesthesia to decrease CO<sub>2</sub> reactivity.<sup>3</sup> Our data indicates that CO<sub>2</sub> reactivity is maintained in spite of changes in I concentration. We have demonstrated an absence of a dose-dependent relationship between I and CBFV while hyperventilation is used. Because the caliber of the basal cerebral vessels do not change in the pediatric population with changes in the CO<sub>2</sub> tensions, we can assume that the changes in CBFV are proportional to changes in CBF.<sup>4</sup> This data indicates that CO<sub>2</sub> reactivity under I anesthesia is maintained in spite of increasing CO<sub>2</sub> concentrations. Patients with raised intracranial pressure undergoing general anesthesia would benefit from the association of hyperventilation and I.

We thank MEDASONICS, Canada for providing the TCD.

1. Anesthesiology, A62, 1974.
2. Can J Anaesth, 36, S89, 1989.
3. Anesthesiology, 71:3, A104, 1989.
4. Pediatrics 70:147, 1982.

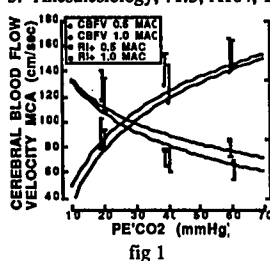


fig 1

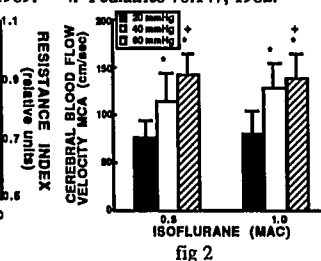


fig 2

## A1222

**TITLE:** THE INFLUENCE OF HYDROXYETHYLSTARCH (HES) ON COAGULATION IN NEUROSURGERY

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There have been several cases reported of hemorrhagic neurologic insults, associated with the prolonged use of large amounts (>2000 ml) of HES (1,2,). High doses of HES produce a decrease in factor VIII-C, F VIII-r-Ag and F VIII ristocetin cofactor, causing a Von Willebrand-like syndrome (3,4).

The purposes of this study were 1) to evaluate the influence of volume replacement with 1 liter of HES on coagulation and 2) to evaluate if this influence is different in patients undergoing intracranial neurosurgical procedures and patients undergoing intra-abdominal gynecological operations. The study was approved by the hospital ethical committee. Four groups of 10 patients were compared: group A and B patients underwent a craniotomy, group A received 1 liter of HES and group B received 1 liter of a 5% solution of human albumin (HA). Group C and D patients underwent gynecological procedures and were treated with HES, resp. HA. Inclusion criteria were: age between 18 and 65, weight between 60 and 75 kg, normal liver- and renal function, normal preoperative coagulation and no intake of drugs, which could influence coagulation. A standard anesthetic regimen consisting of thiopentone, pancuronium, fentanyl, isoflurane and N<sub>2</sub>O was used. Volume replacement was

was carried out with CVP monitoring. Five blood samples were taken: one immediately after induction of anesthesia, the 2nd after administration of 0.5 l HES or HA, the 3rd after infusion of 1 l HES or HA, the 4th and the 5th samples were taken 24 hours, 48 hours resp. postoperative. The following tests were performed: activated partial thromboplastin time (APTT), prothrombin time (PT), fibrinogen (Fg), thrombin time (TT), platelet count (PC), F VIII:C and F VIII R-Ag. Statistical analysis of the results was done by a one way analysis of variance (MANOVA) and a TUKEY test for multiple mean comparison. p<0,01 was considered significant. There was no significant difference in mean blood loss between the patients treated with HES and the patients treated with HA. The changes over time and difference between groups were not significant for the parameters APTT, PT, PC. There was a significant increase in Fg 24 hrs and 48 hrs postoperatively (P<0,001) in the 4 groups but there was no significant difference between groups. There was a significant shortening of the T.T. in groups A and C after infusion of 1 l of HES. F VIII:C and F VIII R-Ag increased significantly over time in the 2 HA groups (p<0,001) and remained unaffected in the patients treated with HES.

In conclusion HES can be used safely in intracranial as well as in general surgery since the observed changes in coagulation parameters remain within physiological ranges, in all groups.

**References:** 1. Anesthesiology 1987, 66:706-707 2. N Eng J Med 1987, 317:964-965 3. Transfusion 1985, 25(4):349-354 4. A.J.C.P. 1987, 88(5):653-655.