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POSTER SESSION X

A201

TITLE: HYPERTONIC, HYPERONCOTIC HYDROXY ETHYL STARCH DECREASES INTRA CRANIAL PRESSURE FOLLOWING NEURO TRAUMA.

AUTHORS: C. Weinstabl, MD, N. Mayer, MD, P. Germann, MD, H. Steltzer, MD, A.F. Hammerle, MD.
AFFILIATION: Clinic of Anesthesia and General Intensive Care, Univ. of Vienna A-1090 Vienna, Austria.

Introduction: Hypertonic, hyperoncotic solutions have recently been introduced for treatment of hemorrhagic shock in polytrauma patients. As only a few studies have worked on the intracranial effects in these solutions we sought to evaluate the effect of 7.5% hydroxyethyl starch 200/0.6 (H) on intracranial pressure (ICP) and cerebral perfusion pressure (CPP) in head injured patients without intracerebral hemorrhage.
Methods: In a total of 10 polytrauma patients with head injury epidural ICP probes were implanted. In order to prevent and treat hypovolemic states 4 ml/kg H were administered when serum osmolality was below 300 mEq/l. While heart rate (HR), mean arterial pressure (MAP), ICP were recorded continuously, H was given over a period of 15 minutes. ETCO2 was kept within 28-32 mmHg. Patients were allocated to group I (ICP<20 mmHg) or group II (ICP>20 mmHg) according to their ICP baseline levels. Data were evaluated 5 and 15 minutes after administration, while serum osmolality and serum sodium was determined before and five minutes after the H infusion. Paired t-test was used for statistical analysis. A p value < 0.05 was regarded as significant.
Results: Hemodynamic data are listed in the following table.

		CONTROL	HES 4mg/kg 5 min	15 min
HR	I	89±9	90±10	88±10
	II	85±11	90±11*	89±10
MAP	I	82±6	89±4	92±6*
	II	91±4	99±5	93±5
ICP	I	11±2	5±1	3±2*
	II	33±4	18±3*	17±3*
CPP	I	71±5	85±5*	89±7*
	II	58±6	83±8*	73±5*

Serum osmolality increased in both groups (group I: 293±4 mEq/l control and 310±4 mEq/l H, p<0.05; group II: 291±4 mEq/l and 304±4 mEq/l, p<0.05). Serum sodium levels increased from 137±2 mEq/l to 145±2 mEq/l in group I and 132±1 mEq/l to 137±1 mEq/l in group II; p<0.05.
Discussion: The beneficial effects of H are reflected by decrease of ICP and increase of CPP, in particular in patients with elevated ICP. The increase of serum osmolality, which is based primarily on increases of serum sodium values, however, stresses the need to control these parameters carefully before H administration.

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BRAIN WATER, ICP AND BRAIN RELAXATION: A COMPARISON OF MANNITOL AND FUROSEMIDE.

Authors: A. Schubert M.D., I. A. Awad M.D., A. D. Perez-Trepichio M.D., Z. Y. Ebrahim M.D., E. L. Bloomfield M.D.,
Affiliation: Cleveland Clinic Foundation, Departments of General Anesthesiology, Neurosurgery and Brain and Vascular Research

Mannitol (M) and furosemide (F) are used to reduce brain bulk during intracranial neurosurgical procedures. They have previously been compared in a heterogeneous group of neurosurgical patients (1), but not with respect to their effect on brain water content. In this study we compared the effects of M and F on ICP, dural tightness and brain tissue water content during temporal lobectomy for seizure control.

After institutional approval and informed consent, 20 adult patients with intractable seizures were randomized to receive either M (0.5 g/kg) or F (0.5 mg/kg) approximately 40-60 min prior to craniotomy. Anesthesia was induced with sodium thiopental 2-4 mg/kg, sufentanil 1-1.5 µg/kg and relaxant, followed by nitrous oxide (60%), isoflurane (<0.5%) and sufentanil by continuous infusion. Fluids were limited to 10 ml/kg Ringer's lactate during induction, followed by an infusion of 1-2 ml/kg/hr. Blood pressure was maintained within 20% of preoperative values. Ventilation was controlled to a $PaCO_2$ of 25 ± 2 mmHg. Mean arterial pressure, heart rate, temperature, end tidal CO_2, end tidal isoflurane, urine output and intravenous fluids were measured at the time of surgical prep (baseline), during the drilling of the first cranial burr hole, prior to lifting of the cranial flap, and with retrieval of the brain tissue specimen. A surgeon blinded to the administration of diuretic assessed dural tightness after removal of the bone flap. Epidural ICP was measured using a Gaeltek device after the first cranial burr hole was made and just prior to lifting of the cranial flap. During the surgical removal of the seizure focus, a specimen (100-500 mg) of gray matter was obtained from the temporal gyrus. The specimen was immediately placed in an airtight container, frozen and preserved for subsequent analysis of wet and dry weight using desiccation by heat at 60°C. Groups were compared using unpaired t-tests and Fisher's exact test.

Both groups were similar with respect to weight, height, gender, and age. Likewise, baseline plasma electrolytes, glucose, osmolality and vital signs did not differ. Table 1 shows ICP, glucose, electrolytes and brain water content after M or F, when measured just prior to removal of the bone flap. At that time of dural assessment, both groups had received an equivalent amount of Ringer's lactate, but urine output was higher with F (1043±412 vs. 423±179 ml; p < 0.05). Brain specimens were obtained 134±24 min after M and 122±21 min after F. At this point, fluids administered were also similar among groups, but urine volume was again lower in Group M (817±291 vs. 1459±596 ml; p < 0.05).

Previously, improved brain relaxation was observed with F alone (2) or when added to M (3). Our data also suggest a trend toward lower ICP and better brain relaxation in comparison to M at a time when M associated augmentation of brain blood volume no longer would be expected (4). One may speculate that the more severe degree of brain dehydration observed with F could account for the trend towards improvement in clinical parameters. The substantial diuresis with F may indicate that this agent's effectiveness depends partially on rapid removal of water and electrolytes from the intravascular compartment.

References:
(1) Anesthesiology 47:28-30,1977
(2) Dtsch Med Wschr 99:932-935, 1974
(3) J. Neurosurg. 56:679-684, 1982.
(4) Can Anaesth Soc J 32:506-615, 1985

Table 1	Mannitol n=11	Furosemide n=9	P
Osmo (mOSM/kg)	293±4	284±14	0.06
K+ (mequ/l)	3.6±0.3	3.2±0.2	0.004
Glucose (mg/dl)	113±37	107±21	0.68
PCO2 (mmHg)	25±3	24±3	0.39
ICP (mmHg)	14±13	8±8	0.24
Tense dura	4/11(36%)	1/9(11%)	0.43
Brain H20%	81.8±2.6	78.9±3.3	0.08