TITLE: HALOTHANE CONCENTRATION BLOCKING CARDIOVASCULAR RESPONSES TO INCISION IN INFANTS AND CHILDREN

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Cardiovascular and neuroendocrine responses to surgical stress could exacerbate patient morbidity, thus, MAC, a value determined by patient's movement to skin incision, might be insufficient for assessing an appropriate depth of anesthesia.[1] Since no report is available as to anesthetic requirement blocking stress response in infants and children, we determined anesthetic doses of halothane blocking cardiovascular responses to incision.

Methods: Sixty-seven unpremedicated children (1 months–7 years), ASA1 and 2, were divided into four groups given halothane and one group caudal anesthesia (table 1). Anesthesia was induced with halothane, N_2O and O_2 by mask and then each patient's trachea was intubated. Mean arterial pressure (MAP, Dinamap), heart rate (HR) and pupil diameter were measured at three times: before induction of anesthesia, at a 10 min steady state end-tidal halothane concentration (ET-Hal), and at the 2 min following skin incision. The ET-Hal was sampled at the end of tracheal tube and analyzed by infrared analyzer (Capnomac, Datex). $ETCO_2$ was maintained at 30-40 mmHg. N_2O, 60%, was continued throughout the study.

More than 10% increase of MAP and HR from preincision to postincision value was treated as an all-or-none positive response. ED50 of ET-Hal for MAP and HR response was determined by the up and down technique. This study was approved by our local review comittee.

Results: ET-Hal blocking AP response in 1-3 y children, 0.86±0.24%, was significantly less than those in the other age (table 1). Changes in MAP were correlated with both changes in HR and changes in pupil diameter in all groups given halothane(table1). ET-Hal blocking HR responses were almost the same as those blocking MAP response (table 2). None of the children undergoing caudal anesthesia showed positive response.

Discussion: We found that the ET-Hal blocking cardiovascular response to skin incision in infants and children were higher than those blocking adrenergic response in adults reported by Roizen et al.[1] Also the difference from MAC of the same age was greater in children than in adults. The reasons for less requirement for halothane in 1-3 y children may relate to asynchronous development of autonomic nervous system responses to adrenergic stimuli.[2]

Table1. ET-Hal Blocking AP Responses

	Halothane 1-6mo	6-12mo	1-3y	4-7y	Caudal A. 1-7y
N	15	12	15	13	12
Age(mo,y)	3.2±1.0	8.0±1.3	2.1±0.6	5.4±0.9	2.8±1.9
BW(kg)	6.3±1.6	8.5±1.2	11.7±2.6	18.1±3.6	12.6±2.9
ET-Hal(ED50,%)	1.12±0.19	1.20±0.14	0.86±0.24*	1.12±0.13	0.33±0.17☆
Correlation coefficients					
ΔMAP-ΔHR	0.52	0.78	0.92	0.84	0.59
ΔMAP-pupil diameter	0.76	0.68	0.87	0.80	-0.55

Mean±1SD, *P<0.01
☆Mean end-tidal halothane concentration, but not the value of ED50

Table2. ET-Hal Blocking HR Responses

	Halothane 1-6mo	6-12mo	1-3y	4-7y
N	13	12	15	12
ET-Hal(ED50,%)	1.15±0.16	1.20±0.14	0.86±0.24*	1.13±0.13

*P<0.01

References:
1. ANESTHESIOLOGY 54:390-398, 1981
2. Circ Res 45:282-292, 1979

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TITLE: INTERACTION OF FENTANYL AND NITROUS OXIDE ON CEREBRAL AND PERIPHERAL HEMODYNAMICS IN NEWBORN LAMBS

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Fentanyl is often administered in com-bination with other agents because it does not produce complete anesthesia.[1] Unfortunately, this may also adversely affect its safety.[1] We sought to determine if fentanyl and nitrous oxide (N_2O) 1) produce anesthesia (absence of movement in response to pain and sound), 2) decrease cerebral blood flow (CBF) and O_2 consumption ($CMRO_2$) and, 3) affect the regional distribution of cardiac output in newborn lambs.

Seven lambs, 3-5 days old, averaging 5.3 ± 0.5 kg, were chronically instrumented for blood flow determination (radiolabeled microsphere technique) and cerebral venous sampling (sagittal sinus). The next day, lambs were placed in a hood with controlled inspired gas concentration which minimized external stimuli. Following 30 min of 50% N_2O in O_2, the lambs were given fentanyl (3 mg/kg) by iv bolus and by infusion (1mg/kg/hr) for 60 min. Data were analyzed by one way analysis of variance with $P < 0.05$ considered significant (*). Organ blood flows are represented as ml/100g/min (mean ± SE).

All animals responded to pain (tail clamp) and alerted to sound when N_2O alone was used. Adding fentanyl abolished responses to pain but not to sound and caused apnea necessitating intubation and ventilation. Mean arterial pressure and heart rate increased 27% and 23%, respectively, following fentanyl. CBF, O_2 delivery and $CMRO_2$ did not change. Blood flow to the abdominal viscera, muscle, and skin was unaffected by treatment or over time (Table). Fentanyl decreased renal blood flow by 21%.

In conclusion, the combination of fentanyl and N_2O produced profound analgesia and a light plane of anesthesia in which response to sound was not abolished nor was $CMRO_2$ decreased. Intestinal blood flow is better maintained in newborn lambs with this anesthetic combination than with fentanyl and barbiturates.[1]

References:
1) Yaster, M: Anesthesiology 70:461-469,1989

Table.

	Control	N_2O	Fentanyl + N_2O	Fentanyl + N_2O, 60 min
CBF	63±5	65±8	67±8	62±5
$CMRO_2$	3.7±0.3	3.9±0.5	4.3±0.6	3.8±0.4
Kidney	377±12	404±33	298±25*	313±32*
Sm Intestine	346±44	344±37	320±37	350±57
Lg Intestine	99±11	84±6	84±9	93±3