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TITLE: ANALGESIC AND PSYCHOMOTOR EFFECTS OF THE SUBANESTHETIC XENON; A COMPARISON WITH NITROUS OXIDE

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Xenon is a rare gas and a more potent anesthetic than nitrous oxide. Nitrous oxide is known to produce remarkable analgesia, however the analgesic properties of xenon have not been investigated. We evaluated the analgesic and psychomotor effect of xenon and nitrous oxide, each at the equipotent dose of 0.3 MAC, in six healthy volunteers (with informed consent and approval by the Research Comittee of our institute). The analgesic effect was determined by the changes in pain threshold using an improved radiant heat algometer(1). The psychomotor effect was assessed by the prolongation in response time to random auditory stimuli. Each subject was evaluated with three gases; 100% oxygen (control), nitrous oxide and xenon at seven days interval. Each subject was evaluated with 100% oxygen (oxygen trial) before than with each gas (gas trial). For the oxygen trial, the measurements were performed before, during and after inhalation of 100% oxygen. For the gas trial, after the pre-inhalation measurements, the subjects were asked to inhale one of the three gases. After an end-tidal concentration equivalent to 0.3 MAC was maintained for over 20 min, the measurements were performed. The end-tidal concentrations of nitrous oxide and xenon were monitored with a Capnomac(Datex) and a Thermomat(Fuji Electric), respectively. Analysis of variance, Dunnett's T test and Tukey's Studentized range test were used to evaluate the inter- and intragroup differences.

The pain threshold was significantly elevated with nitrous oxide and xenon compared to the pre-inhalation values ($p<0.01$) and oxygen trial ($p<0.01$) (Figure). There was no significant difference between nitrous oxide and xenon. The response time was significantly prolonged with nitrous oxide and xenon compared to the pre-inhalation values($p<0.05$) and oxygen trial ($p<0.05$), and it was longer with xenon than with nitrous oxide ($p<0.05$). The present results indicate that xenon has an analgesic effect similar to that of nitrous oxide and its psychomotor effect is stronger than that of nitrous oxide.

Reference
1. Pain 6:141-148, 1979

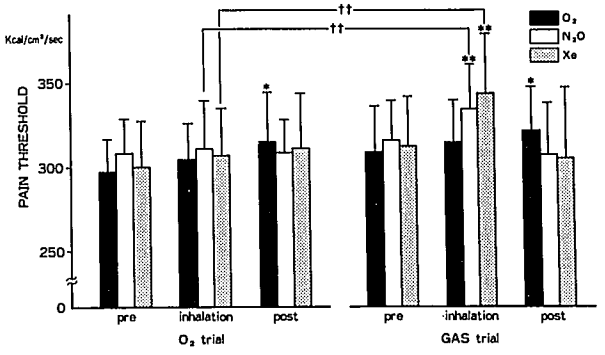

Figure. Changes in pain threshold with xenon and nitrous oxide. *p<0.05, **p<0.01 vs pre-inhalation ++p<0.01 vs oxygen trial

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Title: SEVOFLURANE IN CLOSED CIRCUIT ANETHESIA

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Two compounds were identified when liquid sevoflurane was sealed with soda lime in a glass vial and heated at 70 C for 3 hours (1). In clinical practice of sevoflurane anesthesia using semiclosed system,only about 4 ppm of pentafluoro isopropenyl fluoromethyl ether (PIFE) can be detected at the site of inspiratory limb. It was reported that in experimental closed circuit using model lung,pentafluoro methoxypropyl fluoromethyl ether (PMFE) could be also detected (2). However this system is different from clinical practice because of lack of extreme humidity coming out of the patient lung. In this study,we clinically examined breakdown products of sevoflurane reacted with soda lime in closed circuit anesthesia. Breakdown products of sevoflurane were also examined using model lung where 180 ml of distilled water was added into canister filled with 1.8 kg soda lime. The same sort of study was repeated using model circuit when no water was added. Blood chemistry examinations followed after anesthesia.

METHODS

Ten adult patients were anesthetized with sevoflurane in closed circuit anesthesia after approval from our Human Subject Review Committee. Gas samples in the circuit were obtained every 60 minutes from inspiratory side for gas chromatography analysis. Blood samples for BUN, Cr, GOT, GPT, ALP, LDH, LAP, GGTP were obtained seven and fourteen days after operation. A model circuit was prepared using the same circuit as clinical use. The patient's lung replaced by 1000 ml rubber bag. 200 ml/min of CO2 were introduced into the bottom of the bag. Temperature of soda lime was measrued by thermistor probe.

RESULTS

In all cases anesthesia was smooth and recovery from anesthesia was rapid. No adverse effects on renal or hepatic function have been observed. PIFE was detected after sixty minutes and the concentrations of PIFE were from 10 to 25 ppm. PMFE was detected in seven cases out of ten. In one case,its peak concentration temporarily reached 1.5 ppm,and the others were less than 0.5 ppm. In three cases,PMFE was not detected. In the model circuit when no water was added into soda lime,PIFE increased to 37.5 ppm for 150 minutes and then gradually decreased. PMFE was detected after 90 minutes,and then increased to 10.2 ppm for 300 minutes. When distilled water was added into soda lime, the concentration of PIFE was 33 ppm for 30 minutes and then gradually decreased. Trace amounts of PMFE were detected after 30 minutes,and peak concentration was of PMFE 0.6 ppm. Peak temperature of soda lime usually reached 45 C~48 C in clinical practice and 53 C in model circuit.

CONCLUSIONS

Although PIFE accumulates in closed circuit it has been proved to be non toxic in animal studies. PMFE was hardly detected clinically. In model circuit when distilled water was added into soda lime it was also hardly detected. In this study it is concluded that highly moist soda lime prevents appearance of PMFE even in closed circuit.

Reference
(1)Wallin,R. F. et al.:Anesth. and analg. 54:758-765,1975
(2)Hanaki,C. et al:Hiroshima J Med Sci. 36:61 67,1987