

Respiration

Title :CENTRALLY MEDIATED DEPRESSIVE EFFECT OF HYPOXIA DURING HALOTHANE ANESTHESIA

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Introduction. It has been known that halothane anesthesia reduces hypoxemic ventilatory response(1). Davies et. al. suggested that blunted carotid chemoreceptor reflex may play a role of this reduction(2). However hypoxia not only stimulates carotid body but also has centrally mediated depressive effect on ventilation(3). We examined whether this centrally mediated hypoxic depression is a part of the causes of the reduced hypoxic ventilatory response with halothane anesthesia.

Methods. Five white rabbits weighing 2.5-3.1 kg were used. After induction of halothane anesthesia by face mask, trachea was intubated and connected to the mechanical ventilator. Both carotid sinus nerves were resected, then spontaneous ventilation was re-established keeping end-tidal PO₂ above 200 torr. End-tidal PCO₂ was kept approximately 30 torr by adding CO₂ to inhaled gas mixture. Ventilatory flow was measured with pneumotachograph and minute volume was calculated. After 15 minutes of steady state ventilation, FIO₂ was reduced rapidly to keep end-tidal PO₂ approximately 50 torr for 5 minutes. CO₂ concentration in inspired gas was adjusted in order to maintain end-tidal PCO₂ constant. Arterial blood was sampled during steady state and after 5 minutes of hypoxia. Above experiments were repeated at different levels of halothane concentration. Relation between percent decrease in minute ventilation with hypoxia and end-tidal halothane concentration was examined.

Results. Minute ventilation started to decrease within one minute with hypoxic gas mixture inhalation and became stable within 5 minutes. Results of seven data points are as follows;

changes in minute ventilation %	end-tidal halothane concentration %	PaO ₂ torr	PaCO ₂ torr
-12.3	0.95	40	29
-7.4	1.02	54	33
-12.5	1.05	40	29
-7.0	1.25	54	31
-4.1	1.30	41	30
-4.9	1.80	46	33
-1.9	1.88	45	33

% changes in minute ventilation from the steady state levels to the 5 minute hypoxemic levels and end-tidal halothane concentrations are statistically correlated ($P < 0.05$). (Fig.1)

Discussion.

It has been postulated that centrally mediated depression of ventilation with hypoxia is not a rapid effect. However in these experiments, minute ventilation started to decrease soon after hypoxemia was established. The figure 1 shows that centrally mediated depressive effect of hypoxia is more prominent in light anesthesia. We conclude that centrally mediated depressive effect of hypoxia may be a part of the causes of the reduced hypoxemic ventilatory response in halothane anesthesia.

References.

1. Knill RL, Clement JL: Variable effects of anesthetics on the ventilatory response to hypoxaemia in man. *Can. Anaesth. Soc. J.* 29:93-99, 1982.
2. Davies RO, Edwards MW, Lahiri S: Halothane depresses the response of carotid body chemoreceptors to hypoxia and hypercapnia in the cat. *Anesthesiology* 57:153-159, 1982.
3. Weil JV, Zwillich CW: Assessment of ventilatory response to hypoxia. *Chest* 70:124-128, 1976.

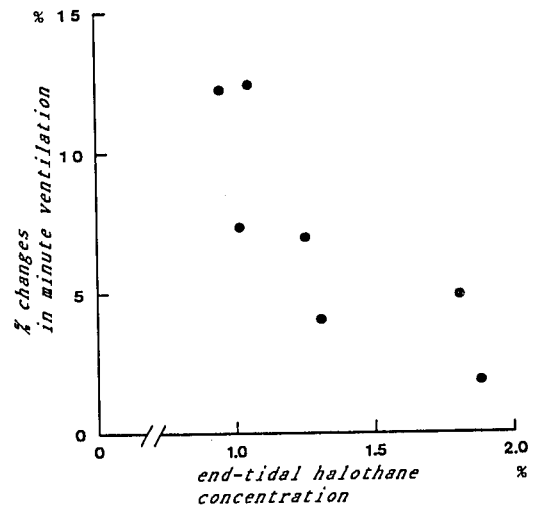


Fig. 1. Absolute value are used for changes in minute ventilation to define the magnitude of depressive effect. Centrally mediated depressive effect of hypoxia is smaller when halothane anesthesia is deeper.