Effect of Halothane Anesthesia on Rate of Canine Oxygen Consumption

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In dogs anesthetized with halothane, increase in halothane concentration from 0.8 to 2.5 per cent (mean expired) was accompanied by a 17 per cent reduction in O₂ consumption (VO₂) and a halving of cardiac output (Q) and arterial pressure. Repayment of an O₂ debt was not observed with return to 0.8 per cent halothane. Values of VO₂ at 0.8 per cent halothane were reduced by measures that reduced Q and arterial pressure (vagal and paired pulse stimulation). Conversely, VO₂ at 1.7 per cent halothane was increased by maneuvers that increased Q and arterial pressure (digitalis and blood or dextran administration). Change in myocardial VO₂ alone is believed to be insufficient to account for the observed changes in whole-body VO₂. Accordingly, the reductions in VO₂ observed with increased halothane concentration may represent indirect effects mediated by halothane-induced changes in the circulation although direct metabolic depressant effects of halothane per se were not ruled out.

The effects of gaseous anesthetics on whole-body O₂ consumption rates (VO₂) have not been established owing primarily to the interference by these agents with analysis for O₂ in blood or gas by conventional techniques. The introduction of paramagnetic, polarographic, and chromatographic techniques of gas analysis has removed this technical obstacle and resulted in a number of studies of the effect of halothane on VO₂. These studies were carried out in a clinical environment, however, and interpretation of the findings has been limited by the use of premedication and thiopental, a limited range of halothane con-

Materials and Methods

All observations were made in unpremedicated dogs (0.6 to 0.9 m², body surface area) placed in the right lateral position. Anesthesia was induced and maintained with halothane in air or in 33 per cent O₂ in N₂. Succinylcholine, 30 mg., was administered prior to the placement of a cuffed tracheal catheter and continued thereafter in amounts believed sufficient (150 mg./hour) to eliminate variations in skeletal muscle heat production and O₂ consumption. Ventilation was kept constant with a Harvard pump at a tidal volume, 0.25 to 0.34 liter, and rate, 7 to 11/minute, adjusted initially to provide approximately normal CO₂ levels, PaCO₂, 31 to 43 mm. of mercury. Desired inspired concentrations of halothane in humidified mixtures were provided by means of analyzed tanks of compressed gases, a flowmeter and halothane vaporizer system, Vernitrol, and a humidifier. A nonbreathing system was used with total collection and volume measurement of expired gases over a period of 15 to 20 minutes. Heating pads and sheets were used, on occasion, to minimize changes in body temperature measured by an esophageal thermistor. Catheters were placed in the left common carotid artery, main pulmonary artery, and right atrium in order to measure pressures and for sampling. Another catheter was placed in a peripheral vein for the administration of fluids, succinylcholine, and

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