TITLE: MONITORING HIGH FREQUENCY JET VENTILATION BY END-TIDAL CARBON DIOXIDE CONCENTRATIONS

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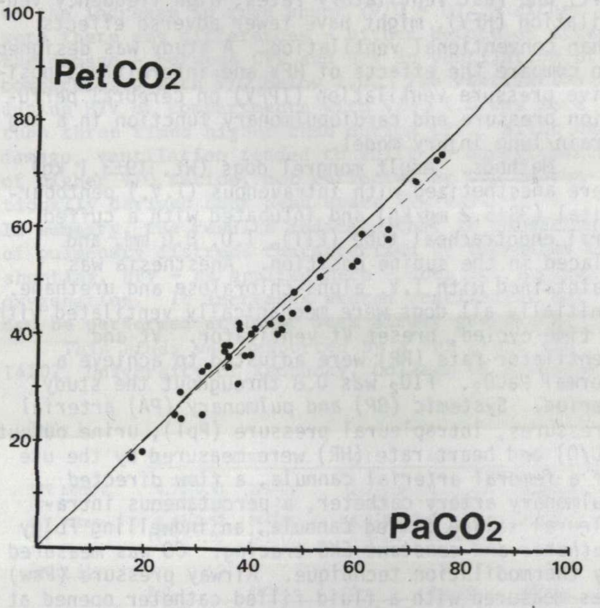
Introduction. Although end-tidal carbon dioxide tensions (PetCO-) may be easily used to monitor the adequacy of conventional ventilation[1], its application in high frequency ventilation has not been studied. The ability to assess the adequacy of carbon dioxide elimination is important in the evaluation of any new form of ventilatory support. We felt it would be important to have a quick, reliable, bedside method of assessing alveolar ventilation before conducting clinical trials. In a series of dogs, we investigated a technique which allows the use of PetCO to monitor high frequency jet ventilation (HFJV).

Methods. Four mongrel dogs were anesthetized with ketamine (10mg/kg im). Anesthesia was maintained with a continuous infusion of pentobarbital at 9-10mg/kg/h. After tracheal intubation, conventional ventilation was established with a Harvard animal respirator, F_IO_2=1.0,V_t=15ml/kg, and a rate that produced a normal PaCO- (37-44 mmHg). After conventional ventilation, various settings of HFJV were used by varying frequency (100-900 breaths/min), inspiratory time (20-40%) and driving pressure (20-40 PSIG). HFJV was delivered by using a Healthydyne Model 300 high frequency ventilator. After 15 minutes on each setting, arterial blood was sampled for PaCO-. The animal was then immediately attached to the Harvard ventilator and the PetCO- of the first tidal breath (15ml/kg) was measured using an in-line infra-red analyser (Hewlett Packard Model 47210A). Statistical analysis utilized linear regression analysis with a level of significance at p<.05 to compare PaCO- to the first PetCO- obtained after return to conventional ventilation.

Results. The PetCO- measured correlated very well with PaCO- over a wide range of arterial CO- tensions (20-80mmHg). Linear regression analysis for this data yielded the following: PaCO-= .98PetCO-+1.9; r=.98; n=37, p < .001.

Discussion. The conventional method of measurement of end-tidal CO- concentrations in the trachea during HFJV may not provide a reliable reflection of arterial CO- tensions because of streaming of inspired gases and tidal volumes that are considerably less than anatomic dead space.[2] After a single tidal volume breath (given by a conventional ventilator or ambu bag) PetCO- can be measured and thus provide immediate feedback about the adequacy of gas exchange with HFJV. We feel that this simple method can be used during clinical trials of high frequency ventilation to assess the adequacy of ventilation with this experimental device.



The figure shows PaCO (mmHg) on the X-axis plotted against PetCO (mmHg) on the Y-axis. The solid line is the line of identity and the dashed line is the regression line for the data.

1. Takki S, Aromma U, Kauste A: "The Validity and usefulness of the end-tidal PCO during Anesthesia", Ann Clin Res 4:278-284, 1972.
2. Capan L, Ramanathan S, Kuntala S, Tedulo P, Chalon J, Turndorf H: "Arterial-end-tidal CO gradients with different ventilatory modes" Anesthesiology 55:A363, 1981 (Abstract).