

TITLE: CO₂ PRODUCTION (VCO₂) RELATED TO ANESTHETIC DEPTH

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Carbon Dioxide clearance from the body reflects the production of carbon dioxide where the ventilation remains constant. It is the purpose of this study to evaluate whether the change in carbon dioxide production (VCO₂) accompanying decreasing depth of anesthesia could be used to predict inadequate anesthetic depth. This information could then be used to modify the control of anesthetic delivery. Does this have any advantage over blood pressure as currently used by many anesthesiologists in their own manual control?

METHOD: An infrared (IR) 930 CO₂ analyzer (with pediatric cuvette) was interfaced to a 900C servo ventilator (Siemens-Elma AB) that was modified for anesthesia delivery to give VCO₂ min production. Heart rate and Blood pressure were inputted via R wave monitor and oscillometric machine. Patients ranged from 10 months 22 Kg to 62 yr 84.1 Kg. Anesthesia was maintained with Isoforane-N₂O. Towards the end of the surgery the inhalation agent was lightened and Fentanyl (1-2 ug/Kg) was administered. End-expired anesthetic concentration was measured using an Engstrom analyzer placed beyond an inline heat moisture exchanger (breath-aid). In smaller children, time constants for a significant change to occur were as short as one minute. Attempts to use compressed spectral array analysis of EEG patterns were not successful due to the time requirement of the analytic technique.

RESULTS: VCO₂ predicted changes as well as blood pressure changes (Table 1). The heart rate did not correlate well to isoforane. Heart rate

decreased after fentanyl administration so it was not included in this data.

TABLE 1 VCO₂ (%) vs BLOOD PRESSURE (%) CHANGE (n=16, mean ± SD)

<u>ANESTHESIA LEVEL CHANGE</u>	<u>VCO₂ CHANGE</u>	<u>BP CHANGE</u>
Control to Pre-incision	-20 ± 7.3	-18.5 ± 16.34
Deep to Light Anesthesia	+19.5 ± 13.1	+17.3 ± 12.20
Fentanyl Bolus*	-11.6 ± 4.8	-20.6 ± 16.28

* Two patients decreased 72% if these patients are included the mean VCO₂ is +21.7% ± 25.03

DISCUSSION: The VCO₂ is readily available with the Siemens 900C anesthesia ventilator. The data presented is corrected for ambient pressure and temperature. If corrections are applied for humidity, N₂O interference, barometric pressure, and temperature, a constant of 0.79 would need to be included VCO₂ measured from the airway gas can be used to reflect changing level of anesthetic depth. This will not be true where gross changes in ventilation occur, where the end-tidal to arterial CO₂ relationship is changing, or where body stores of CO₂ are changed rapidly (leg tourniquets are released). Blood pressure and VCO₂ can be used together to predict the changing milieu of anesthetic depth versus surgical stimulation.