Title: SEVERITY OF EXPIRATORY VALVE INCOMPETENCE (EVI) ALTERS MINIMUM INSPIRED CARBON DIOXIDE ($PMICO_2$) AND CAPNOGRAM

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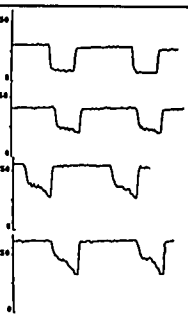
We conducted this study to determine whether the severity of EVI alters $PMICO_2$ and the capnogram.

A mechanical lung model was infused with CO_2 at 150 ml/min and ventilated via a semiclosed circle anesthesia breathing circuit (Baxter, 750 ml) by an anesthesia ventilator (Ohmeda 7000) adjusted to maintain an exhaled tidal volume of 700 ml, respiratory rate of 10 breaths/min, and an inspiratory-to-expiratory (I:E) ratio of 1:2. The fresh gas flow rate was 5 L/min of O_2. A calibrated mainstream capnograph (Novametrix 1260) continuously measured CO_2 between the endotracheal tube and the breathing circuit Y-piece. Four degrees of EVI were studied: small, created by placing a 0.7-mm obstruction between the valve disc and the valve seat; moderate and large, created similarly with 1.6 and 4.2-mm obstructions; and complete, created by removing the valve disc from the valve assembly. After creating each EVI and achieving CO_2 equilibration, $PMICO_2$ and peak expired CO_2 ($PETCO_2$) and the capnogram were recorded. Volume of retrograde flow through the valve was recorded by a turbine volume monitor (Ohmeda 5420). Each EVI was studied 5 times. Mean volume of retrograde flow, $PMICO_2$, and $PETCO_2$ were compared at each EVI by ANOVA (Tukey's test for multiple comparisons).

Increased severity of EVI increases retrograde flow through the expiratory valve ($P < 0.01$), increases $PMICO_2$ ($P < 0.01$) and $PETCO_2$ ($P < 0.01$), and results in the appearance of a notch late in the inspiratory baseline (phase I) of the capnogram (Table). Future descriptions of capnograms should include precise specifications of the clinical or test conditions.

Table. Retrograde Flow and CO_2 Characteristics of Different Degrees of EVI

Vol. of Valve Block	Retrograde Flow (ml)	Capnogram	$PMICO_2$ (mmHg)	$PETCO_2$ (mmHg)
0.7 mm	131 ± 7		8 ± 1	30 ± 1
1.6 mm	343 ± 7		18 ± 2	39 ± 2
4.2 mm	476 ± 5		29 ± 1	56 ± 3
Complete	511 ± 15		32 ± 2	62 ± 3

Values are means ± SD, n = 5.

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TITLE: HUMIDITY AFFECTING A CHEMICALLY BASED MONITOR OF EXHALED CARBON DIOXIDE

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A new, disposable monitor (Fenem FEF), inserted between the endotracheal tube (ETT) and the "Y" piece of the breathing circuit, detects exhaled CO_2 by the chemical reaction:

$$CO_2 + CO_3^{=} + H_2O \longrightarrow 2HCO_3^{-}.$$

The purpose of the study was to determine whether airway relative humidity (RH) affected this monitor.

A mechanical lung (CO_2 inflow, 200 ml/min) was ventilated (0.5-L breaths, 9 breaths/min); a humidifier and capnograph sensor were inserted between the lung and an ETT. End-tidal CO_2 was kept between 35 and 40 mm Hg. RH was measured with a hygrometer. The monitor was tested 5 times each with gas at a RH of 81%, (humidifier "off"); 97%, (humidifier "on" at 37°C); and 82%, (humidifier "on" and heat moisture exchanger [HME] between the ETT and monitor). Each test was conducted until only a 2-color change registered on the monitor's 6-color gauge during a respiratory cycle. A 2-color change was interpreted as the end of the monitor's operational life. Data were recorded every minute for 20 min and then every hour for 5 hr. Data were analyzed by ANOVA and Tukey multiple comparisons test.

Time to only a 2-color change at a RH of 97% was significantly shorter than for drier conditions of 81% and 82% RH (Fig.).

Reducing RH of the exhaled air by the insertion of a HME to trap moisture before it reaches the chemical CO_2 monitor markedly prolongs the operational life of the CO_2 monitor.

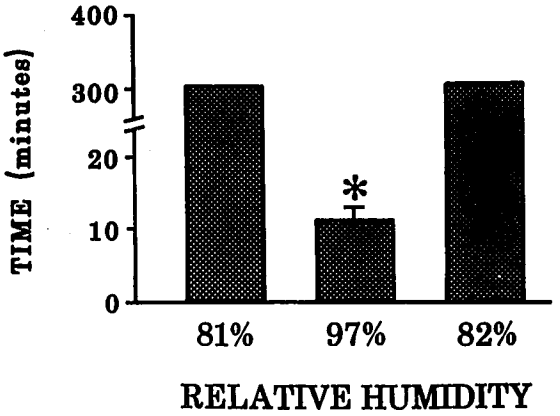

Fig. Times (mean ± SD) for the chemical monitor to register only a 2-color change on 6-color gauge during respiration at three levels of RH (*$P < 0.05$).