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A476

Title: INCIDENCE OF REAL AND FALSE POSITIVE CAPNOGRAPHY AND PULSE OXIMETRY ALARMS DURING PEDIATRIC ANESTHESIA.

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The increasing number of monitors used during pediatric anesthesia has created the problem of being able to distinguish between real and false alarms.

Methods: The data presented was abstracted from an institutionally approved prospective study of combined pulse oximetry and capnography.[1] Patients were randomly assigned to four monitor conditions (oximeter and capnography, only oximeter, only capnography, neither monitor available) and continuous recording was made of the ECG, pulse plethysmogram, oxygen saturation, and $PECO_2$. A separate observer was present throughout each anesthetic and recorded all events which lead to desaturation, hyper- or hypocarbia. A record was kept of all alarms. The oximeter alarmed when the $SpO_2 \leq 85\%$; the capnograph alarmed when there was no CO_2 for ≥ 15 sec. Alarm categories were: 1) real, i.e., true desaturation or lack of CO_2 sensing due to a disconnect, 2) artifactual, i.e., without a physiological abnormality, but rather an interference with the normal monitor function, e.g., blood pressure cuff inflation or pressure on a finger or toe causing the oximeter to fail; a poor mask fit causing the capnograph to indicate no CO_2 for 15 seconds or more due to a pause in ventilation, and 3) false alarm, i.e., an alarm caused by a technical failure.

Results: A total of 28,506 min of anesthesia were monitored, 18,910 by endotracheal tube and 9,596 by face mask. There were 2,161 artifactual and 127 false capnography alarms. There were 1,126 artifactual and 274 false oximeter alarms. Only 268 alarms were real (8 events sounded both alarms). Thus, of the combined 3,956 alarms, 83% were artifactual, 10% were false and only 7% were true alarms with potential physiologic consequences. The incidence of artifactual and false alarms was similar in all four monitor groups. There was an average of 7.8 artifactual and false alarms per hour of anesthesia.

Discussion: False alarms are distracting and may be hazardous since the anesthesiologist might tend to disable the alarms to quiet the noise. Many of the artifactual alarms are avoidable by simple measures, such as putting the oximeter probe on a different arm than the automated blood pressure cuff or in a location where it could not be affected by pressure. Many capnograph alarms could be prevented by better mask fit or extending the alarm parameter time period beyond 15 seconds. Care should be taken not to destroy the benefits of extensive monitoring by "noise pollution".

References:
1. Anesthesiology 73:A1125.

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A477

TITLE: CARDIAC OUTPUT METHOD FOR USE DURING ANESTHESIA

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A noninvasive, multiple inert gas method for near continuous measurement of cardiac output (C.O.) and several other cardiopulmonary variables, has been reported in a companion paper. Utilizing the airway as an inert gas injection and measurement port, the method claims to provide unbiased measurements independent of the subject's ventilation/perfusion (V/Q) status without the requirement for calibration from an external source. Absolute measurements are obtainable without the requirement of an airtight seal at the airway by utilization of bolus injection of tracer gases, synchronized with inspiration, giving rise to the name Synchronous Tracer Injection (STI) for the method.

The major purpose of the validation study described in this paper is to test the claim of method nonbias over a wide range of C.O. values for a given size animal. This study also demonstrates the degree to which the method can follow rapidly changing C.O. values.

The electromagnetic flow meter (EMFM) was chosen as the standard for flow measurement, being blood flow calibrateable to within 2% absolute. To provide positive control of C.O., a pump was surgically placed between the central venous supply and the right heart. The EMFM placed at the output of the pump provided the C.O. standard.

The data pairs for an 18 dog study is presented in figure 1. The slope of the regression line is 1.02, with a s.d. of 0.14 liters/min.

The inter dog bias values were statistically significant from zero for only three of the 18 dogs.

Representative examples of the ability of the STI method to follow changes is illustrated in Figure 2.

The results of this study demonstrate that by analysis of multi inert gases applied noninvasively at the airway, absolute measurements of C.O. are obtainable in subjects with moderately abnormal lungs assuming that S_aO_2 and Hb are independently obtainable. (The opportunities and consequences of noninvasive S_aO_2 and Hb measurements are also discussed.) Of particular significance is the fact that the values of the inert gas blood:gas partition coefficients used in the calculations had been obtained from a previous group of dogs. The apparent lack of significant bias in STI C.O. measurements were obtained with lungs having sufficient nonuniformity of V/Q which would create bias errors averaging 19% had a single rather than multi compartment model been applied to the data.

The results also demonstrate satisfactory cardiac output monitoring using low flow over these curcuits and an endotracheal gas leak.

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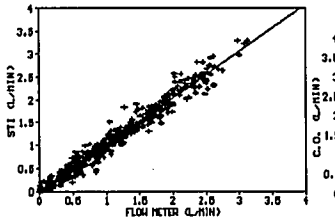

Figure 1.

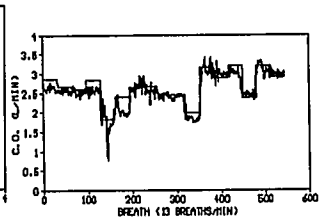

Figure 2.