Volumetric Capnography as an Indirect Assessment of Cardiac Output in an Acute Respiratory Distress Syndrome Swine Model

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Background:

- Volumetric capnography has the potential to assess cardiac output (CO) in critically ill patients
- ARDS is a a severe form of acute lung injury characterized by acute hypoxemic respiratory failure and increased physiological dead space to tidal volume ratio (V_d/V_t)
- The utility of volumetric capnography to assess CO in patients with ARDS has been sparsely described

Aims:

- The primary aim of this study was to assess the correlation between the VCO_2 and $ETCO_2$ with CO in a swine model of ARDS
- The secondary aim was to determine whether changes in VCO_2 and $ETCO_2$ correlates with changes in CO after a fluid challenge

Methods:

- Animals weighing 23±3 were sedated, intubated, and mechanically ventilated
- ARDS (PALICC definition) was induced using continuous infusion of oleic acid at 0.05-0.6 mL/kg
- Animals received a fluid challenge of 0.9% Sodium Chloride at a rate of 100 mL/min over 10 minutes once before induction of ARDS, and once in ARDS
- Respiratory and hemodynamic variables were continuously monitored

Key Take Aways:

- Understanding the correlations between $ETCO_2$, VCO_2, and CO could allow early detection of hemodynamic changes and the immediate assessment of the impact of interventions among critically ill pediatric patients
- Clinicians should consider the limitations associated with using $ETCO_2$ and VCO_2 in patients with Acute Lung Injury

Results:

	CO (L/min)	VCO_2 (mL/min	$ETCO_2$ (mmHg)	V_d/V_t	Correlation Coefficient (r)
Baseline (n=16)	4.12 ± 1.23	98.37 ± 19.38	39.75 ± 3.46	.26 ± .09	.41, .46 (p=.001)
ARDS	3.42 ± .71	112.72 ± 22.97	49.23 ± 9.73	.43 ± .08	.26, .34 (p=.001)

Mean values of CO, VCO_2, $ETCO_2$, and V_d/V_t during baseline and ARDS settings. R represents Pearson correlation coefficients between CO with VCO_2 and $ETCO_2$ respectively.

- **The correlations pre and post fluid challenge were not statistically significant before and during ARDS (p=0.11 and p=0.16)**

Data Analysis:

- Pearson's correlation coefficients and linear regression were used to assess association between measurements

Conclusions:

- Continuous measurements of $ETCO_2$ and VCO_2 can be used as surrogate markers for CO in the absence of acute lung injury
- Neither VCO_2 nor $ETCO_2$ were able to detect fluid responsiveness following fluid challenge

Next Steps:

- Increase sample size
- Assess these relationships in physiologically unstable states like cardiac arrest and during CPR performance

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