Carbon Dioxide and Stan

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Basic CO_2 information related to Stan:

Baseline values: $PvCO_2$ 44 mmHg, $PaCO_2$ 40 mmHg, $PACO_2$ 38 mmHg
Arterial $PaCO_2$ is the trigger for breathing spontaneously-- (default is 40 mmHg)
Alveolar CO_2 affects pH on the HUD

HPS Parameters affecting CO_2 values

Direct
Venous CO_2 shift
CO_2 production factor
Oxygen consumption
Respiratory quotient
Fixed neuromuscular blockade
Minute ventilation
$PetCO_2$ – $PaCO_2$ factor

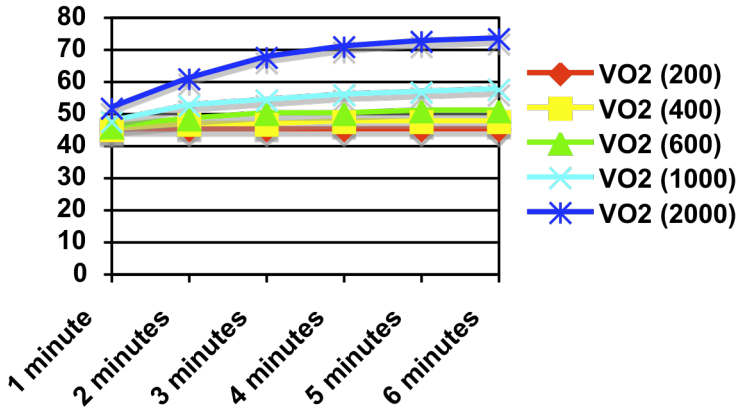
Indirect (changes morphology of CO2 waveform)
Bronchial occlusion
Chest wall compliance factor
Chest wall capacity
Distended chest wall compliance
Intrapleural volume

Pathophysiological states

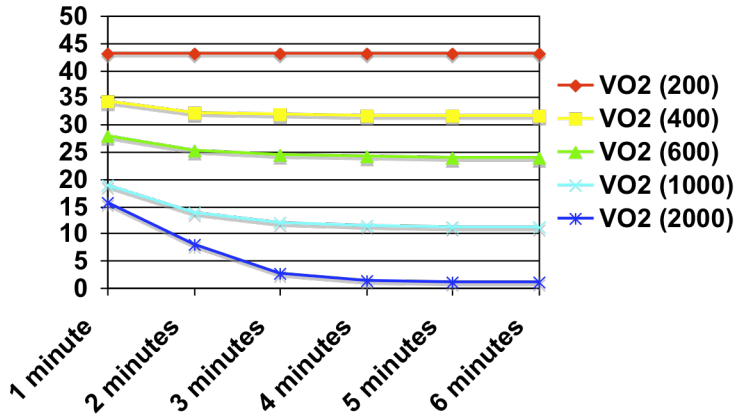
Intubation during CPR (with good compressions/ vs poor compressions)
Manipulate the Arterial – to $ETCO_2$ difference.

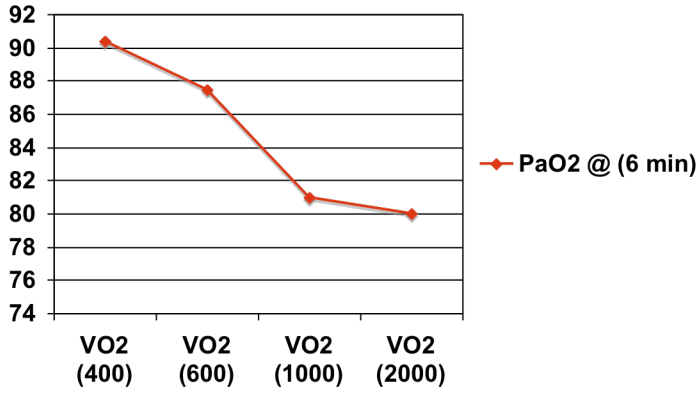
Fever or overall increase in CO_2 Production
Lets compare different methods:
How fast do you want it to rise?

Manipulations in Oxygen Consumption producing changes in $PvCO_2$ during apnea

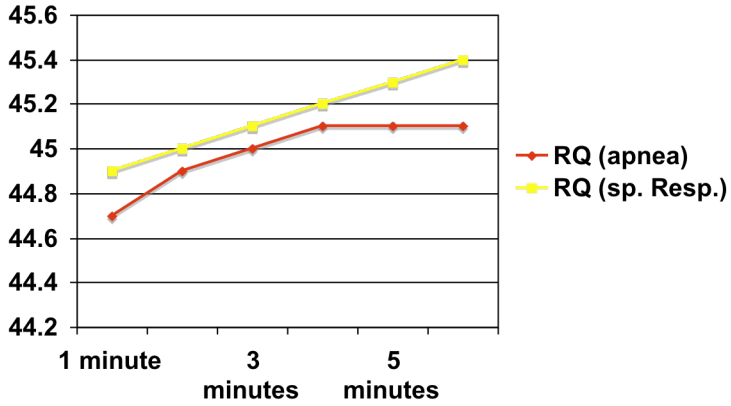


Manipulations in Oxygen Consumption producing changes in PvO_2 during apnea

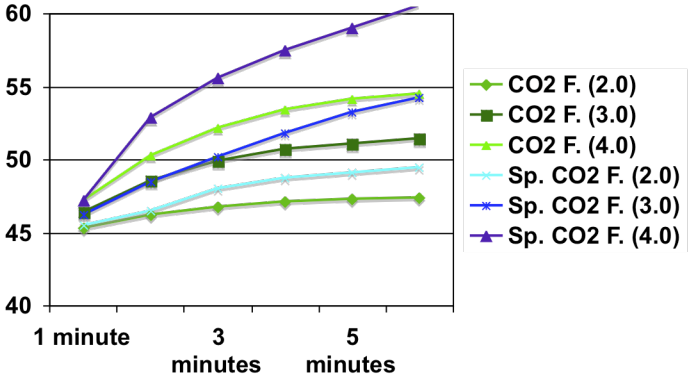




Respiratory Quotient (1.0) $PVCO_2$ changes occurring during apnea versus spontaneous breathing



CO_2 Production Factor Apnea versus Spontaneous Ventilation



Different methods of creating a good respiratory acidosis

Within a Scenario:

Baseline
Ischemic sensitivity to 0.1

Give Morphine state
Volume/Rate Control Factor to 2.3
Tidal Volume Factor to 0.3
Venous CO2 shift to 30 mmHg

CO2 curve shifts
CO2 setpoint to 50 mmHg

Hemodynamic/pulmonary changes related to acidosis
HR Factor to 1.82 over 60 seconds
Shunt fraction to 0.36

Apnea

Open a saved acidotic patient

Respiratory acidosis (verification by increased ETCO2)
Increase CO2 production (by any means)
Change CO2 setpoint gradually after CO2 begins increasing

Or may decrease RR factor and TV factor. This method only produces a mild acidosis, not one that needs much intervention.

Bicarbonate administration/ tourniquet release

Manipulate the Venous CO2 shift

What if there is no CO_2 gas?

Within approximately 1 minute, Stan will stop breathing. All 3 CO2 parameters on the HUD will begin to slowly decrease, with the PvO2 being the last. All 3 of the oxygen parameters will slowly increase. pH will continue to rise without CO2 present.

Can use RR override and TV override to create spontaneous breathing. Once breathing begins the oxygen parameters will begin to decrease, this is because if Stan is breathing room air, most of the gas is nitrogen. Just realize the other gases will not be normal.