Capturing Captivating Capnography Capabilities

EtCO2 Uses Beyond Tube Placement

EMS State of the Science XXI
March 1, 2019
Normal Capnograph

By default capnography provides information on ventilation, perfusion and metabolism
Asthma and Capnography

- EtCO$_2$ less than 28 or greater than 50 associated with poor outcome (intubation, ICU admission, mortality)
- EtCO$_2$ did not distinguish mild from more severe disease in pediatrics

Cardiac Output and Capnography

- Increased cardiac output = increased EtCO₂
  - Return of spontaneous circulation
- Decreased cardiac output = decreased EtCO₂
  - Cardiac arrest
  - Massive pulmonary embolism
  - Hypovolemia
Pulmonary Embolism and Capnography

- PE decreases perfusion of a segment of the lung
  - Ventilation remains unchanged
- PE increases alveolar dead space
- Tachypnea decreases EtCO₂
- PE flattens the slope of phase III due to redistribution of blood flow
Capnography in Trauma

- EtCO$_2$, respiratory rate (RR), systolic BP (SBP), diastolic BP (DBP), pulse (P), and oxygen saturation (SpO$_2$) and hospital data.
- Cut-off value at 30 mmHg yielded sensitivity 89% (51-99), specificity 68% (59-76), PPV 13% (6-24) and NPV 99% (93-100) for predicting mortality.
- Improve triage and assisting EMS in directing patients to an appropriate trauma center.

Other Potential Uses

- Post-partum hemorrhage
- Gastrointestinal bleeding
- Ruptured ectopic pregnancy

- No studies have looked at these conditions in the prehospital setting
DKA and Capnography

- **Adults**
  - A blood glucose greater than 550 mg/dL and EtCO₂ of 28 mmHg or less good predictor
  - A blood glucose greater than 550 mg/dL and EtCO₂ greater than 35 mmHg can rule out DKA

- **Pediatrics**
  - EtCO₂ < 29 mmHg pretty good predictor
  - EtCO₂ > 36 mmHg can rule out DKA


In sepsis, EtCO$_2$ demonstrates an inverse relationship with lactate level.

Hypoperfusion of the organs leads to an increase in serum lactate and lactic acidosis.

An EtCO$_2$ less than 25 mmHg is a strong marker for severe sepsis.

Was the strongest marker of all prehospital variables examined.

Practical Applications
What are we really doing?

- Nasal capnography skeptics
- Eagles survey 18 months ago
  - Multiple different uses
  - A few themes
What are we really doing?

- Well-accepted applications
  - Confirmation of airway with waveform
  - Termination of resuscitation
- Monitoring sedation or overdoses
  - Need for ventilatory support
  - Need for airway support?
  - Hold medications
What are we really doing?

- Respiratory monitoring
  - Use of waveforms to guide treatment
  - Use of predictive numbers vs trending
  - CPAP challenges (washout, sample)
- Sepsis evaluation
  - Marker of perfusion
Magic numbers

- 10 ➔ TOR
- 25 ➔ Hypoperfusion, acidosis
- 50 ➔ Hypoventilation (maybe)

How do we change management?
Sepsis

- Limitations on vitals
- EtCO2 as a marker
- Earlier ED attention
CCEMS

Fever / Infection / Suspected Sepsis

Universal Patient Care Guideline
Consider Appropriate PPE and/or indicated infection control measures

Temperature > 100.4°F (38°C)

- YES

Obvious or suspected infection AND Adult Patient meets criteria for Sepsis / Severe Sepsis

- NO

Exit to Appropriate Guideline

Possible Sepsis (Any 2 SIRS):
- Temp: ≥ 100.4°F (38°C) OR
- Temp: < 96.8°F (36°C)
- RR: > 20 bpm
- HR: > 90 bpm

Severe Sepsis / Shock
- Sepsis (2 SIRS) AND
- SBP: < 90 mmHg OR
- EtCO2: < 26 mmHg

Vascular Access Guideline
Consider Normal Saline 500 mL bolus, if appropriate for patient condition.

Notify Receiving Hospital of Sepsis, Do NOT provide alert.

Charleston County Clinical Guidelines 2019-03

Notify Destination or Contact Medical Control

M

M
DKA Case

- 59 yo F worsening AMS x 2 days
- GCS 13
- BG high
- HR & BP, RR
- EtCO2 11
- No hyperkalemia on ECG
DKA Case

- Little change w/ NS 600 mL
- Little change w/ PDP
- Any other options?
Closing Thoughts

- Capnography should become a standard vital sign
- Capnography has a place in patient assessment
- Place sick or potentially sick patients on capnography
- Do not wait for an advanced airway prior to using capnography
- Use capnography as a severity marker
Thank You

Questions?

Scott Gilmore
  - gilmorew@stlouis-mo.gov

David French
  - DFrench@charlestoncounty.org