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CAPNOGRAPHY CASES REVIEW
VIRGINIA EMS SYMPOSIUM 2015
Objectives

1) **Review:** components of the capnography waveforms and the physiology behind the waveform

2) **Apply:** capnography monitoring in critical care patients, through case reviews

3) **Integrate:** Capnography into daily practice to promote consistency and patient safety.
Presentation

- Capnography Overview
  - History
  - Anatomy and Physiology
  - Pathophysiology of respiration and ventilation
- Case Presentations
Capnography 2015

- Assesses Ventilation
  - Airways and Support
    - Bag-mask
    - ETI and rescue airways
    - Transport vent
    - CPAP?
  - Spontaneous ventilation
    - Sedation
    - Altered Mental Status
Capnography 2015

- 2010 AHA Guidelines
  - Class I, LOE A
  - 100% Sensitive, 100% Specific
- Quantitative, continuous, waveform capnography
  - Monitor position of airway devices
  - Quality of CPR
- “C-A-B” approach
  - Circulation-Airway-Breathing
2010 AHA Recommendations

- (1) the use of quantitative waveform capnography for confirmation and monitoring of endotracheal tube placement is now a class I recommendation in adults; and
- (2) the routine use of cricoid pressure during airway management is no longer recommended.

2015: devices other than capnography have limited value in monitoring quality of resuscitation.
**AHA Levels of Evidence**

<table>
<thead>
<tr>
<th>Level A</th>
<th>Level B</th>
<th>Level C</th>
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<tbody>
<tr>
<td><strong>Multiple populations evaluated</strong>&lt;br&gt;Data derived from multiple randomized clinical trials or meta-analyses</td>
<td><strong>Limited populations evaluated</strong>&lt;br&gt;Data derived from a single randomized trial or nonrandomized studies</td>
<td><strong>Very limited populations evaluated</strong>&lt;br&gt;Only consensus opinion of experts, case studies, or standard of care</td>
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<tr>
<th>Class I</th>
<th>Class Ila</th>
<th>Class Iib</th>
<th>Class III</th>
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<tr>
<td>Benefit &gt;&gt;&gt; Risk&lt;br&gt;Procedure/Treatment SHOULD be performed/administered</td>
<td>Benefit &gt;&gt;&gt; Risk&lt;br&gt;Additional studies with focused objectives needed&lt;br&gt;IT IS REASONABLE to perform procedure/administer treatment</td>
<td>Benefit ≥ Risk&lt;br&gt;Additional studies with broad objectives needed; additional registry data would be helpful&lt;br&gt;Procedure/Treatment MAY BE CONSIDERED</td>
<td>Risk ≥ Benefit&lt;br&gt;Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL</td>
</tr>
</tbody>
</table>

- **Recommendation** that procedure or treatment is useful/effective
- **Sufficient evidence** from multiple randomized trials or meta-analyses

**Suggested phrases for writing recommendations**: should <br>is recommended <br>is indicated <br>is useful/effective/beneficial

**Risk**: Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL
Capnography

- Quantitative, graphical measurement of instantaneous CO2 concentration
- American Society of Anesthesiologists (ASA) standards:
  - Every patient receiving anesthesia shall have adequacy of ventilation continually evaluated.
  - Continual monitoring for the presence of expired carbon dioxide shall be performed unless invalidated by the nature of patient, procedure, or equipment.
  - Continual EtCO2 analysis, in use from the time of ET placement, until extubation/removal or transfer ...shall be performed by a quantitative method such as capnography, capnometry, or mass spectroscopy.
ILCOR: 2015 Draft Treatment Recommendations
International Liaison Committee on Resuscitation

- We suggest that ETCO$_2$ $\geq$ 10 mmHg, measured after the intubation or at 20 min of resuscitation, may be a predictor of ROSC (weak recommendation, low quality of evidence).

- We suggest that ETCO$_2$ $\geq$ 10 mmHg, measured after the intubation, or ETCO$_2$ $\geq$ 20 mmHg, measured at 20 min of resuscitation, may be a predictor of survival at discharge (weak recommendation, low quality of evidence).

- Although certain ETCO$_2$ cutoff values appear to be a strong predictor of ROSC and mortality, their utility in accurately predict outcome during CPR is not established. Thus, we recommend against using ETCO$_2$ cutoff values alone as a mortality predictor or on the decision to stop the resuscitation attempt (weak recommendation, low quality of evidence).
Primary Application in EMS

- Confirmation of Airway Placement
  - Validates Clinical Assessment
    - Visualization
    - Auscultation
    - Observation
  - Definitive confirmation!
  - Chest X-ray: Single point in time
  - Qualitative Detector: Single point in time

- Capnography!: Continuous verification of placement
Intubation RE-Confirmation

- Bag-Valve Movement
- Re-adjustment of ET placement
  - “Pull back 3 cm”
- When you move the patient...
  - Floor to stretcher
  - Stretcher to ambulance
  - Load/unload
  - Stretcher to stretcher
- Patient Self-Extubation
  - Is their problem fixed??!!
Not the Pulse Oximeter

- Oxygenation measured by Pulse Oximetry
  - Measures bound hemoglobin
  - New guidelines titrate to 95-97%
- Adequate Ventilation
  - Quality chest-rise and fall
  - Quality of gas exchange

- Quality over Quantity
Capnography

- Provides measurements of:
  - Ventilation: movement/elimination of CO2 by pulmonary system
  - Perfusion: how well CO2 gets removed by the vascular system
  - Metabolism: how effectively CO2 is being produced by the cells
History of Capnography

- Developed in 1961 (For practical purposes)
- Expensive and bulky product limited to OR anesthesia
- In mid 1980s, anesthesia related fatalities led to need for improvements in airway management
  - Malpractice costs rise 1975 to 1985
History of Capnography

- 1988: Anesthesia standardized use of pulse oximeters and capnography
- Standardized practice reduced death, malpractice claims
- Monitoring tools moved from handheld devices to integrated monitors in EMS
  - 1990s to current
  - What was your first pulse oximeter?
Capnography

- Anesthesia: industry standard and part of surgical routine
- Hospital Emergency Departments and ICUs: *Application varies*
  - *Facility dictates*
  - *Equipment may or may not be available*
  - *Lack of familiarity and comfort decreases use.*
- EMS: IS an expected standard, but variables include
  - Waveform versus colormetric
  - *Comfort* leads in increased application
  - Ability to connect to ePCR
Capnography Requires

- Proper set equipment setup
- Understanding the numbers mean
- Recognize Limitations and idiosyncrasies
A&P for Capnography:

- What is important:
  - Air movement
  - Surface area of lungs
  - Blood flow to lungs and body

- Respiratory Cycle
  - Alveolar level
  - Cellular level
Aerobic Metabolism

- Oxygen and Glucose metabolize:
  - produce Energy to do work
- Carbon Dioxide and Water are the byproducts
  - Krebs Cycle
- Most efficient process
  - Improves with exercise
Review of Metabolism

- Anerobic:
  - Lack of oxygen causes build up of acids
  - Lactic Acid and Pyruvic Acid

- Buffer System
  - Hydrogen Ions of the Acid (pH) combine with Bicarbonate to form Carbonic Acid
  - This breaks down into water and carbon dioxide
  - Increased CO2 stimulate increased ventilation rate to remove it
Carbon Dioxide

- By-product of normal respiration
- Measured as a Partial Pressure
  - 35-45 Mm/Hg
- Measured as a Percentage
  - 5-6%
- Key for: respiratory drive, pH balance
- Considered “acidic”
Drive to Breathe

- CO2 triggers breathing
  - Goal “Normal” 40mmHg
- NOT ENOUGH
  - Hypoventilation = hypercarbia
  - Respiratory acidosis
- TOO MUCH
  - Hyperventilation = hypocarbia
  - Respiratory alkalosis
CO2 on the BRAIN

- Decreased CO2 from hyperventilation
  - Cerebral Vasoconstriction
- Indication: (old school)
  - Traumatic head injury/CVA
- GOAL: Maintain perfusion without worsening bleeding
  - End-tidal CO2 target is 35mm/Hg
- HYPERVENTILATION
  - 16 to 20 breaths/minute
  - NOT 60 breathes per minute
CO2 on the Brain

- Elevated CO2
  - Permissive Hypercarbia
  - Above 45mm/Hg
  - With adequate OXYGENATION!

- Potential Benefits
  - Cerebral and systemic vasodilation
  - Increase cellular oxygen supply
  - Decrease oxygen demand
Atmospheric Gases

- Convert percentage to pressure
- Normal gas Percentage
  - Oxygen at sea level: 21%
  - CO2 and other gases: 1%
  - Nitrogen: 78%
What do the numbers mean?

- **Oxygen and Carbon Dioxide**
  - **Hypoventilation:**
    - $O_2 < 60\text{mm/Hg}$
    - $CO_2 > 45\text{mm/Hg}$ (Hypercapnea)
  - **Hyperventilation:**
    - $O_2 > 100\text{mm/hg}$ ($SaO_2$ above 98%)
    - $CO_2 < 35\text{mm/Hg}$
Dalton’s Law: Partial Pressure of Gas

*Total pressure of a gas is equal to the SUM of the partial pressures of the gas*

- Atmospheric pressure is 760mm/Hg at sea level
- Under NORMAL conditions, all of the atmospheric gas pressures add up to 760
  - Oxygen is 159.2 mm/Hg
  - Nitrogen is 592.8 mm/Hg
  - CO2 is 0.23 mm/Hg
  - Other gases, like Argon = 8mm/Hg
Partial Pressure

- Gradient
- The exchange of gases based on pressure gradient
  - Pressure forces Oxygen onto Hemoglobin
Pathology that Impacts CO2

- **Ventilation Problems**
  - Inability to move air in and out of the alveoli
  - Hyperventilation, hypoventilation

- **Perfusion Problems**
  - Oxygen transport to cells
  - Lack of blood flow
  - Ability of blood to carry oxygen
Normal Ventilation/Perfusion

From pulmonary artery

Airway

Alveolus

Alveolarcapillary membrane

Normal V/Q

To pulmonary vein
Where is the blockage?
Clinical Conditions: Increased CO2

- Increased CO2 production
  - *Bicarbonate administration, fever, seizures, sepsis, thyroid storm*

- Decreased alveolar ventilation
  - *Hypoventilation, muscular paralysis, respiratory depression, COPD (retaining CO2)*

- Equipment Problem
  - *Rebreathing, ventilator leak*
Clinical Conditions: Decreased CO2

- Decreased CO2 production
  - Cardiac arrest, hypotension, hypothermia, pulmonary emboli, pulmonary hypoperfusion

- Increased alveolar ventilation
  - Hyperventilation

- Equipment Problems
  - Airway obstruction, esophageal intubation, ETT leak, incomplete exhalation, poor sampling, ventilator disconnect
Normal EtCO2 waveform

Exhalation: Rapid Rise

Plateau: between breaths

Ventilation: Return to baseline

Baseline: no CO2 detected
Sidestream vs. Mainstream
Sidestream

- Most Common EMS Devices
  - Zoll X, LP15, Phillips
- Easier to use non-invasively
- Key is quality of the patient’s respirations
  - Shallow is poor
  - Mouth breathing is challenging
  - Newer devices assist in increasing accuracy
- Sidestream is LESS specific because of its engineering
- Trend lower
Side-stream Detector
Sidestream Detector

Cannula with mouth scoop

Oxygen and sensor
Mainstream Detector

Sensor at end of cable
Disposable adapter to ET tube
“Real time” values-best for critical care
As the gas passes the IR sensor

Concerns:
Not easily adapted to non-intubated patient
Can be heavy for pediatric of infant ET tubes
Cable is expensive
Troubleshooting!

False Positive
- May occur if patient ingested large amounts of carbonated beverage
- Limited IF continuous capnography in place: waveform may occur, then goes away
- Can deceive colorimetric detector

False Negative/Low EtCO2
- May indicate poor quality CPR
- Pulmonary Embolism
- Poor blood flow and delivery of CO2 to lungs
  - Poor Perfusion
Troubleshooting!

- Sudden loss of waveform
  - IMMEDIATE CLINICAL RECONFIRMATION
  - Lung sounds, SaO2, Anything else
- Place colorimetric detector
- Clean/Clear sensor
  - Blockage
  - Vomit can clog
- Recalibrate/zero if able
- Replace adapter
Waveform Presentations

- What are you seeing?
- What can your physical assessment tell you?
  - Differential Diagnosis?
  - Trouble shooting?
Case 1

![Graph showing CO2 levels over time]

- **Y-axis**: Mm/Hg
- **X-axis**: Time
- **Data**: The graph shows three peaks representing CO2 levels over time.
Case 1

- Respiratory Distress
- 54 y/o COPD
- Respiratory Rate: 24
- Pursed lips
A wrinkle...Ami...

- EMS uses NRB mask as neb mask
  - “Partial Non-Rebreathing mask”
  - Uses flaps to allow exhalation
  - Only use oxygen
- How do you deliver your neb treatments?
  - Medical Air?
  - Oxygen?
- What are the effects of CO2 retention?
Obstructive Airway Disease

- Shunt problem
- Asthma, COPD, Emphysema
  - Swelling of airways/excess mucus
  - Airflow turbulent
  - Forceful expiration
- Different EtCO2 presentations:
  - Mild=hyperventilation, low EtCO2
  - Moderate=normal EtCO2, waveform change
  - Severe=elevated EtCO2, sharkfin
Asthma Pathology
Impaired Ventilation
Shunt Problem
Practice Evidence Capnography

- Journal of Breath Research, March 2013
- “Forced Expiratory Capnograph and Chronic Obstructive Pulmonary Disease”
  - Measuring the slope of the expiratory plateau
  - Correlation with slope and severity of emphysema
- Limitations:
  - Mainstream detectors and small population
Case 2

CO2

0 10 20 30 40 50

CO2
Case 2

- 65 year old obese trauma patient
- Predicted Difficult Intubation
- Multiple Injuries
  - Chest Contusions
  - Abdominal Distention
  - Fractures of right upper leg, left lower leg, and right arm
- Intubation after progressive worsening of Respiratory Distress
Case 2

- Initial Et CO2 6-7mm/Hg
- Intermittent sensor detection of numerical value
- Waveform present
- Low “shark fin” appearance
- What is going on?
- Is the ET good?
Shock

“A rude unhinging of the Machinery of Life”
- Samuel Gross, 1872

“A momentary pause in the act of death”
- John Collins Warren, 1895

“Pushing back the edge of death”
- Judy Mikhail, 1999
Case 2

- Clinical Considerations:
  - Type of Shock?

- Interventions:
  - Ventilation?
  - Fluids?
  - Needle Decompression?
  - Vasopressors?
Shock

- Body’s compensatory mechanisms working; vital sign changes
  - Altered mental status
  - Pale, clammy, diaphoretic
  - Increased heart rate and respiration
  - Decreased blood pressure
Shock and Capnography

- A Piece of the Puzzle
  - Anaerobic compensation for decreased perfusion:
    - Blood CO2 elevated
    - Ventilations increase
    - End tidal CO2 DECREASES
  - Cardiac Output drops:
    - Vasodilation vs. hypovolemia:
    - CO2 decreased as detected by EtCO2
Shock and Capnography

- Index of Resuscitation
  - Quality of perfusion
  - Quality of ventilation

- A TOOL, like ALL monitors:
  - Understand its limitations

- Information HELPS GUIDE decisions

- CANNOT MAKE THE DECISION!
Case 3

CO2
Case 3
Case 3

CO2

Mm/Hg

Time

CO2
Case 3

- 26 year old MVC at community hospital
- Intubated in ED after becoming combative
- Vitals:
  - BP 164/92, HR 130, Respirations 24, SaO2 97%; on ventilator
- Ventilator Settings: Assist/Control
  - Rate 12, TV 500, FiO2 50%, PSV 10, PEEP 5
Case 3

- **Clinical Considerations:**
  - What is going on?
  - Distance to definitive care
  - Mode of Transport

- **Interventions:**
  - Settings changes
  - Medications
Case 4: Initial

![CO2 Graph](image-url)
Case 4

- 50 year old cancer patient receiving radiation and chemo
- Presents with respiratory distress to EMS
  - SaO2: 85%, dramatic work of breathing, becoming tired
  - CPAP Trial; failed and became apneic
- Intubated without RSI
- Vitals: BP 140/88, HR 78, vented at 10 with SaO2 of 93% with 100% FiO2
- Initial EtCO2 is 85mmHg
- EMS: “something is not right with end tidal!”
Case 4: After ventilator placed

![Graph showing CO2 levels over time with peaks at 20 Mm/Hg.]
Case 4

- Community ED requests transfer to tertiary care for Pulmonary Embolism
- Post Intubation ABG:
  - pH 7.31, PaO2: 140, PaCO2: 49mmHg, Bicarb 27
- CO2 gradient:
  - PaCO2 – PetCO2 (49 minus 20 equals 29mmHg)
  - Normal gradient 3 to 5mmHg
- What is in the blood is not getting out
Pulmonary Embolism

- Dead Space Ventilation
  - Decreased EtCO2
- Clot breaks loose in blood vessel
  - Floats to and obstructs pulmonary vasculature
- Causes:
  - Post surgical
  - Sitting for extended time
  - David Bloom, NBC News in 2003
Case 5 Initial: No pulses
Case 5

- 21 year old female
- Witnesses cardiac arrest on athletic track, defibrillated by AED
- BLS and ALS procedures per protocol
- No pulses or vitals
Case 5: No pulses

CO₂
Case 5 Variant

CO2

Time
Cardiac Arrest and CO2

- In cardiopulmonary arrest
  - CO2 levels in blood stream increase
  - Exhaled CO2 levels decrease due to low flow states
    - No ventilation, no circulation of blood
    - No perfusion
  - Cambridge journal Article

- Return of Spontaneous Circulation (ROSC)
  - Spike in EtCO2 after trend of low levels
Case 6

CO2

Mm/Hg

CO2
Case 6

- 48 year old COPD
- Cyanotic, lethargic
- Vitals: HR: 131 A-fib, BP: 158/100, RR: 32, SaO2 on NRB: 90%
- After intubation, EtCO2 35mmHg
- Patient beginning to wake, and move head
Case 7

![Graph of CO2 levels over time](image)
Case 7

- 2 year old female with new onset seizures
- Inter-facility transport for tertiary care
- Intubated / Ventilated by BVM
  - 4.5 ET uncuffed
- Vitals: HR 160, BP 84/40, Ventilated at rate of 36, SaO2 100%, Temp: 103
- Ventilator: FiO2 100%, PEEP 5, initial I:E 1:2.7
Case 7

- **Capnography**
  - Initial level: 98mm/Hg
  - Shape: elevated box shape, irregular respiratory pattern at rate of 36

- **What are your actions?**
  - Increase rate?
  - Change I:E ratio?
  - ET problem

- **How might etiology change treatment?**
  - Asthma
  - Trauma
Case 8

![CO2 Graph](image)

- **Y-axis:** Mm/Hg
- **X-axis:** Time
- **Graph Label:** CO2
Case 8

- Interfacility transport:
  - 56 year old male admitted with “fever”
  - Diagnosed with “sepsis:
- PMH: ESRD, IDDM, CAD, CHF
- Lethargic, GCS 12,
- Vitals: 84/60. HR 130, respirations 10 irregular
- Intubated electively for transport
- Initial EtCO2: 21mmg/Hg
Case 8

- Capnography:
  - Reason for Low EtCO2?

- What are your corrective actions?
  - Decrease ventilation rate?
  - Fluids?
  - Pressors?
  - Blood products?
Case 8

- Consider:
  - BP of 140/90, HR 110, RR 28
  - EtCO2 of 28mHg
  - Respiratory alkalosis as an initial compensation for metabolic acidosis
    - Capnography considered a potential triage tool.
Case 9

![Graph showing CO2 levels over time with two peaks at different intervals.](image-url)
Case 9

- Patient with isolated extremity entrapment
- Awake, oriented, agitated and in severe pain, 10/10
  - BP 150/70, HR 118, R 20, SaO2 100%
- Movement of extremity increases agitation and pain
- Do you have a sedation protocol?
Sedation:
- Different levels based on need

EMS sedation considerations:
- Extrication
- Cardioversion
- Psychiatric/Behavior crisis
Case 9

- Goal of Sedation: induce lowered state of consciousness to tolerate procedures while maintaining their own cardiorespiratory functions
- Hospital: often involves MORE than 1 medication
- All those we warn you about....
Case 9

- Conscious Sedation Monitoring parameter
  - What is required?
- What do we need to know while monitoring the patient?
  - Apnea?
  - De-saturation
  - Agitation?
Case 9: Sedation

- Quality of ventilation
- Detection of Apnea
- Predictor of Compromise
De-saturation curve

Practice Evidence

- “A randomized controlled trial of capnography during sedation in a pediatric emergency setting”
  - Langhan, et al

**Assessed:**
- Hypoventilation
- Interventions
- Desaturation
Practice Evidence Capnography

- When present and used:
  - Reduced rate of hypoventilation
  - Improved Timeliness of interventions
  - Hypoventilation directly related to Hyponea
    - Not taking a breath

- Study also noted:
  - Routinely NOT used by non-anesthesia personnel
Literature

 ENA Emergency Nursing Resources
  • Level B: Moderate clinical certainty
  • Likely Beneficial
Case 10
Case 10

- 21 year old male c/c chest pains
- Sudden onset
- Stabbing, non-radiating, 10/10
- Tingling in his fingers
Reality
Case 10

End-tidal by Nasal Prongs
Case 11: Cruising Along

CO2

0 10 20 30 40 50

CO2
Case 11: Sudden Change!

CO2
Case 11

- Female trauma patient
  - Unrestrained driver with steering wheel deformity; found under dash after airbag deployed
  - Pattern of injury??
- Intubated successfully
  - Confirmed by waveform sedated and paralyzed
- 25 minute flight to Trauma Center
Case 12

- 57 year old obese male with spinal trauma
  - Fell forward, hyper-flexion of neck
  - Confirmed C5, C6 fractures
- CNS Intact-full movement
  - GCS of 9T (14 if not intubated)
- Intubated: and we did not know how
  - Sedation/fiberoptic ETI by anesthesia
- On T-piece, NOT VENTILATED breathing on his own
Case 12: Volume Ventilation

CO2

40

50
Case 12: Pressure Ventilation

CO2

CO2
Case 12

- Considerations:
  - Community hospital to Level 1 trauma Center
  - Patient obese: 280 pounds
  - Aircraft: EC135
  - No existing ventilator settings; crew discretion on “optimal”
  - Difficult airway on multiple dimensions
    - Confirmed by CXR prior to movement
Case 12

- Pressure versus volume ventilation
  - Pressure Control 24, FiO2 100%, Rate 12, Assist Control with PSV
  - Switch to BVM after desaturation
- Sedation, paralysis, pain control
- How might a different airframe change management? Or ground unit?
  - Bell 407 vs. 412
  - EC130 vs EC 135/145
Case 12

- Physical restriction of breathing
  - Burns
  - COPD
  - Trauma
  - Surgical
Case 13

- 55 year old male overdose
  - History of treatment for opioid abuse
- Progressive respiratory depression
- Noted multiple “Suboxone” patches on arms.
- EMS summoned when level of consciousness deteriorated
Case 14

- 24 y/o patient in head on MVC
- Altered LOC, combative, signs of head injury
- RSI clinical course
  - Etomidate 0.3 mg/kg
  - Succinylcholine 1.5 mg/kg
- After paralytic, patient developed trismus and rigidity
- Unable to intubate, but can ventilate with oral airway in place
  - Unable to open mouth to place King LtD
Case 14 Malignant Hyperthermia

- Life Threatening
- Hypermetabolic state in patients with hereditary skeletal muscle defect
  - Genetic predisposition 1:10000
  - Clinical Incidence 1:30000
- Depolarizing muscle relaxants (Succinylcholine) and anesthetic gases cause raise in myoplasmic calcium
Malignant Hyperthermia: Signs and Symptoms

- Hypercarbia: most sensitive indicator in intubated patient
- Tachycardia
- Tachypnea
- Temperature elevation
- Hypertension
- Dysrhythmias
- Acidosis

- Hypoxia
- Hyperkalemia
- Skeletal muscle rigidity
- Myoglobinuria
MH Management

- Get help!
- Hyperventilate patient with 100% oxygen
- Cool patient
- Antidote is Dantrolene
  - Truly the only effective treatment
  - Operating rooms have an MH cart stocked with multiple bottles

- Prehospital considerations
  - Non-depolarizing paralytic
  - Benzodiazepines
Other Applications:

- Respiratory monitoring
  - Overdose/Ingestion
- Cardiac Output
  - LVAD
Documentation

- Initial CO2 waveform and numerical value
- Continuous tracing
  - Software dependent
- Turnover to receiving hospital personnel
So what does this tell us?
Summary:

- Capnography is a TOOL
  - Does not substitute for good clinical skills
- Remember the BASICS
  - ABCs
- DO NOT OVER-THINK Capnography
  - Some cases will be difficult to figure out
Sources:


Cooper, J. B. Medical Technology: Patient Safety is Paramount.


Sources:


