



**REGION 11
CHICAGO EMS SYSTEM
PROCEDURE**

Title: Capnography - ALS

Section: Airway/Ventilatory Management

Approved: EMS Medical Directors Consortium

Effective Date: May 17, 2021

CAPNOGRAPHY - ALS

DEFINITIONS

Capnography: Analysis and recording of carbon dioxide (CO₂) concentrations in respiratory gases via continuous waveform.

End-Tidal CO₂ (ETCO₂): The amount of carbon dioxide measured at the end of exhalation.

INDICATIONS

- All patients receiving positive pressure ventilations (BVM or advanced airway)
- Confirmation of advanced airway proper placement (i-gel or endotracheal tube)
- Monitor correct position of the advanced airway over time
- Ventilation management
- Early detection of return of spontaneous circulation (ROSC) in patients in cardiac arrest

CONTRAINDICATIONS

None

EQUIPMENT

- Cardiac monitor
- Capnography (ETCO₂) filter line set
- Bag-valve-mask or advanced airway

PROCEDURE

1. Apply personal protective equipment: gloves.
2. Attach capnography filter line set to the cardiac monitor.
3. Verify that the capnography display appears prior to applying the device to the patient. This zeros the device to ensure an accurate reading.
4. Apply the capnography device immediately upon initiating any positive pressure ventilations, or as soon as possible.
5. During bag-mask-ventilation, maintain a continuous seal in order to obtain accurate capnography readings.
6. When an advanced airway is placed, the capnography device shall be applied/re-applied immediately to confirm airway placement, along with assessing bilateral breath sounds and absence of gastric sounds.
7. Visualization of a normal or elevated value with a corresponding normal waveform confirms placement. Extremely low values (<10 mmHg) without the typical waveform implies esophageal placement and the



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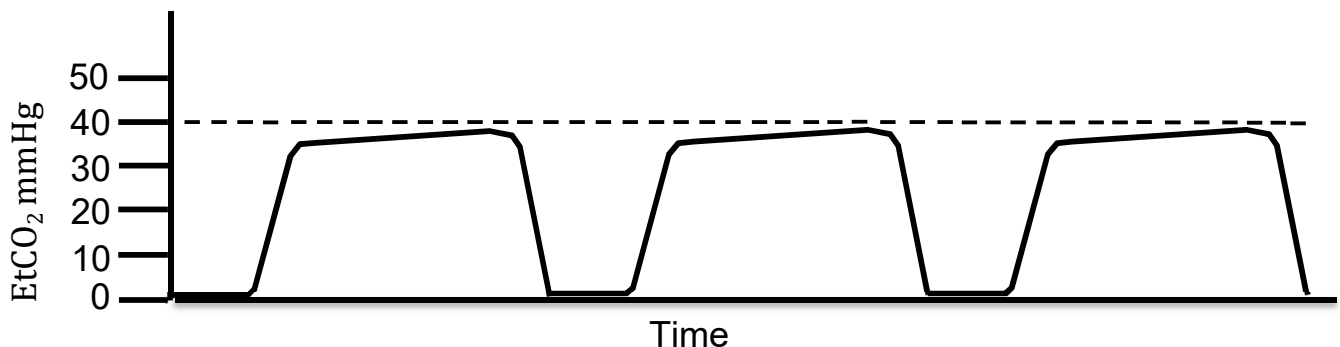
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endotracheal tube should be removed. For patients in shock or cardiac arrest, the value (and height of the waveform) will likely be reduced but the shape of the waveform should be normal.

8. Continuously monitor the waveform, report the capnography reading to Online Medical Control and document capnography reading on the patient care record as follows:
 - a. Immediately after placement of an advanced airway
 - b. With any change in patient condition
 - c. After any patient movement
 - d. Every five minutes during transport
 - e. Upon transfer of care
9. For patients in cardiac arrest, continuously monitor capnography during resuscitation. A sudden rise in ETCO₂, along with an organized rhythm, is a reliable sign of ROSC and should prompt a pulse check at the end of the compression cycle. Do not hyperventilate regardless of the ETCO₂ value; elevated values will normalize with proper ventilation. A drop in ETCO₂ below normal can signify progressive hypotension or re-arrest.
10. A “shark-fin” waveform on ETCO₂ monitoring indicates bronchospasm; treatment with albuterol is indicated.
11. During positive-pressure ventilation, if a “shark-fin” pattern and/or an elevating ETCO₂ waveform (“breath stacking”) is visualized, decrease ventilation rate to avoid increases in intrathoracic pressure, which can lead to decrease in venous blood return to the heart and cardiopulmonary arrest.
12. If the ETCO₂ filter line becomes kinked or clogged with fluid, disconnect and reconnect the filter line set or exchange it.
13. Capnography should be used immediately and continuously any time an advanced airway is placed.
14. Capnography monitoring data should be uploaded to the electronic patient care report.

CAPNOGRAPHY WAVEFORMS

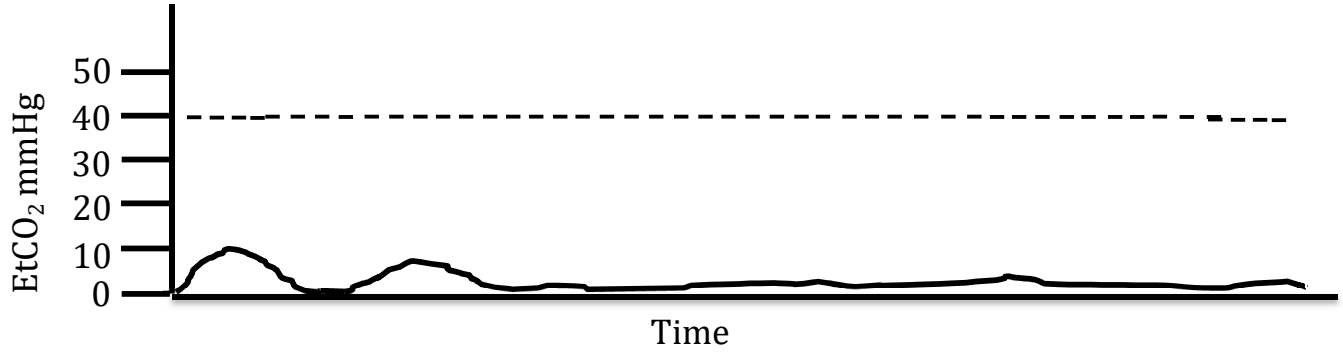
Normal shape of the capnograph (Normal waveform is depicted below)



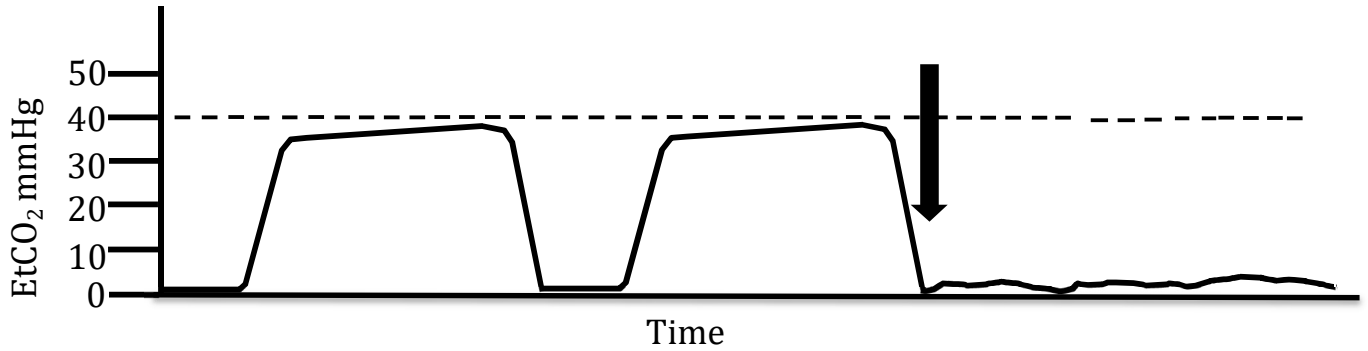


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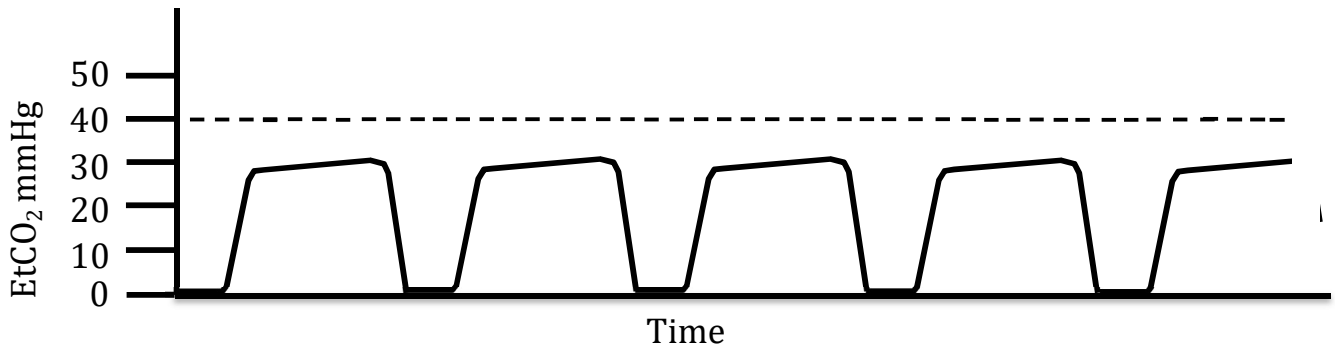
Esophageal Intubation (Low values <10 and irregular waveform or flat line)



Obstructed or Dislodged Endotracheal Tube (Sudden loss of normal waveform followed by low irregular waveform or flat line)



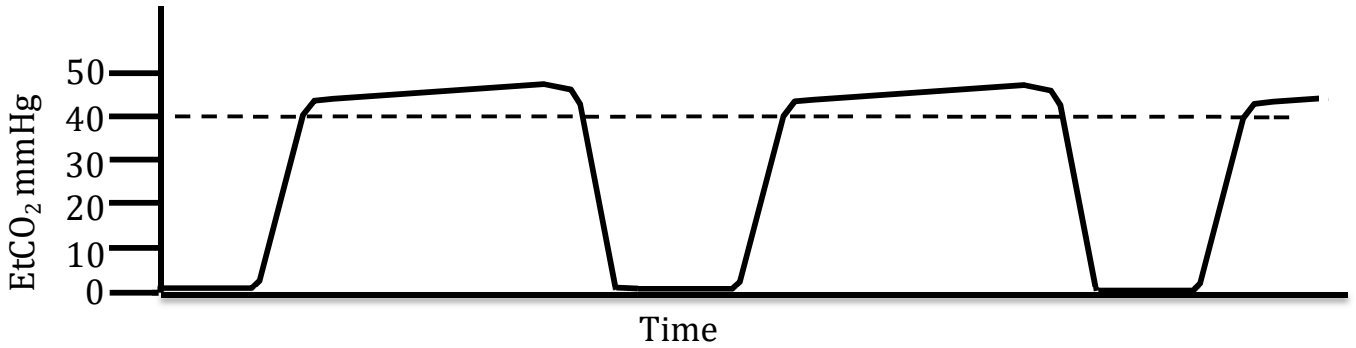
Hyperventilation (Normal waveform with reduced height, <35mmHg, and high ventilation rate)



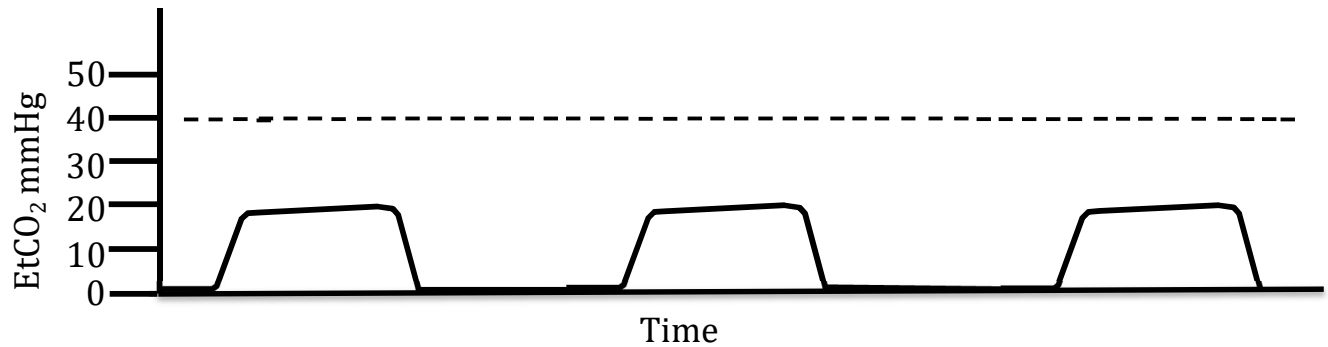


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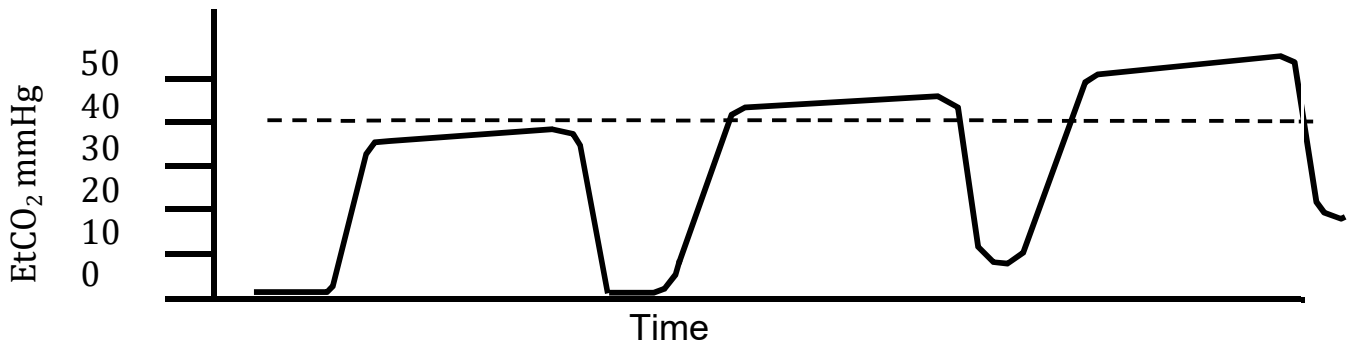
Hypoventilation / Bradypnea (Normal waveform with increased height, >45mmHg)



Hypoventilation / Low tidal volumes (Normal waveform with reduced height, <35mmHg, and slow ventilation rate; A similar reduced height waveform can also be seen with shock – see progressive hypotension below).



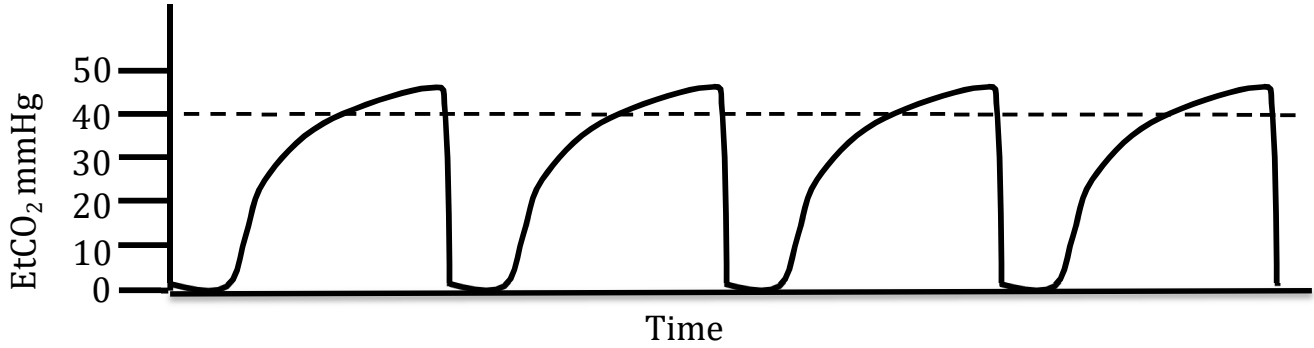
Air Trapping / Breath Stacking (Box wave forms that show increasing values with each successive breath)



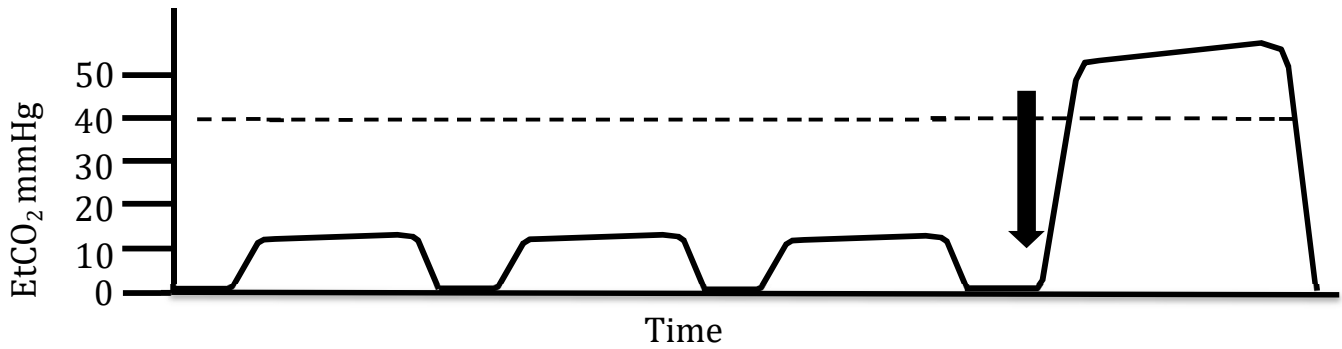


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Bronchospasm ("Shark Fin Pattern")



Return of Spontaneous Circulation (Sudden increase in values in a patient in cardiac arrest)



Progressive Hypotension or Re-arrest (Progressive decrease in values with each successive breath)

