Advisory 25-02 Minimum Standards for Invasive Airway Confirmation and Monitoring

To: All ALS Agencies and Paramedic Clinicians

From: Jeremy T. Cushman, MD, MS, EMT-P, FACEP, FAEMS
Regional Medical Director

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At their February 24, 2025 meeting the REMAC approved the regional policy entitled “Minimum Standards for Invasive Airway Confirmation and Monitoring”. That Policy is attached and available HERE.

Agency leaders are expected to distribute this policy to all clinicians at their agency.

This policy is in effect immediately.

With any questions, please do not hesitate to contact this office.

web www.mlrems.org
phone (585) 463-2900
fax (585) 473-3516

office
44 Celebration Drive, Suite 2100
Rochester, NY 14620

mailing
601 Elmwood Avenue, Box 655
Rochester, NY 14642

MINIMUM STANDARDS FOR INVASIVE AIRWAY CONFIRMATION AND MONITORING

PURPOSE

To establish the minimum standard for invasive airway confirmation and monitoring by EMS clinicians in MLREMS.

BACKGROUND

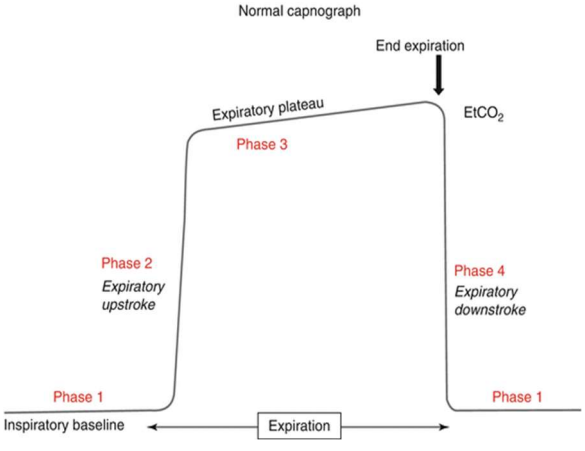
An unrecognized misplaced or non-functioning invasive airway, such as an endotracheal tube (ETT) or supraglottic airway (SGA), is a lethal patient safety event, as it guarantees a failure to ventilate or oxygenate. Waveform capnography has proven to be the most accurate and reliable method for recognizing esophageal intubation and providing ongoing monitoring.[1–4] Early research found that using waveform capnography for prehospital ETT confirmation reduced unrecognized esophageal intubation rates from 23% to 0%.[3] Other confirmation methods—such as visualizing the tube passing the cords, auscultating breath sounds, and using colorimetric capnometry—are less reliable and insufficient for ensuring proper placement.[5,6] Breath sound auscultation is valuable for detecting right mainstem intubation once the tracheal intubation is confirmed with capnography. Waveform capnography should also be utilized on an ongoing basis to monitor for airway displacement.

Similarly to ETT, SGAs are also prone to mispositioning, which can result in failure to oxygenate or ventilate.[7] Waveform capnography serves as a critical tool to prevent unrecognized SGA failure.[8] Quality improvement initiatives in a large metropolitan EMS system demonstrated that incorporating waveform capnography feedback reduced unrecognized SGA failures from 20% to 1.4%.[9]

This evidence underscores that waveform capnography is not merely a “gold standard” but the minimum standard for ensuring the safety of patients requiring invasive airway placement. The National EMS Quality Alliance (NEMSQA) has established a quality measure for waveform capnography use, defined as the “percentage of successful advanced airway procedures performed during an EMS response originating from a 911 request in which waveform capnography is used for tube placement confirmation and monitoring.” [10] Proper confirmation requires the presence of a four-phase waveform with an end-tidal CO2 value $\geq$ 5 mmHg, distinguishing the airway as non-esophageal. Notably, even during cardiac arrest, end-tidal CO2 values $\geq$ 5 mmHg can be achieved.[4]

Capnography Waveform Interpretation

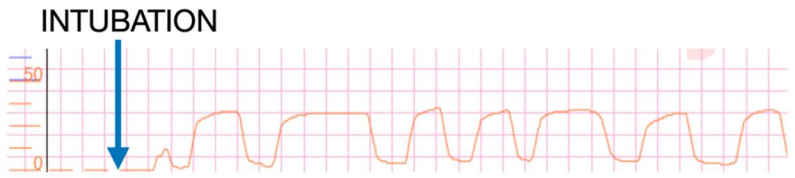
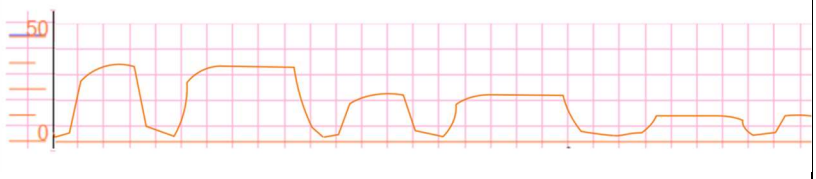
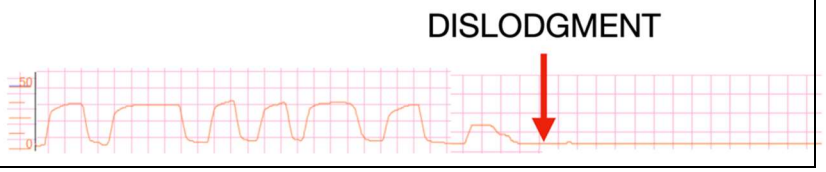
A four-phase end-tidal CO_2 waveform is one that has all phases of ventilation. Phase 1 (inspiratory baseline) followed by Phase 2 (sudden increase in waveform as CO_2 being exhaled) Phase 3 (alveolar plateau where exhalation continues) and Phase 4 (sudden return to baseline indicative of inhalation or positive pressure ventilation).



While there are normal variations in the end-tidal waveform with an invasive airway in place, due to clinical factors such as bronchospasm, pulmonary edema, or over-breathing, the minimum value standard applies in all the above clinical situations. Esophageal placement may generate a brief $EtCO_2$ tracing, but this will rapidly extinguish within about six breaths. This initial $EtCO_2$ signal may be caused by carbon dioxide which has been insufflated into the stomach during bag-mask ventilation.

Approved 2/24/2025

Below are examples of waveforms consistent with correct and incorrect placement of invasive airways.

Correct placement: 4-phase with sustained end-tidal value ≥ 5 mmHg.	
Incorrect placement: While there may initially be a $EtCO_2$ waveform, this rapidly extinguishes to nothing or value < 5 mmHg. This waveform is consistent with esophageal intubation.	
Correct airway placement but drop in patient perfusion: Because $EtCO_2$ value also reflects patient perfusion, the value can drop with a decrease in perfusion (for example, poor compression quality in cardiac arrest or the development of cardiac arrest in a patient who initially had a pulse). However, the waveform will be preserved, and the value should remain ≥ 5 mmHg. This same waveform dynamic can occur with hyperventilation.	
Airway dislodgment: Sudden loss of $EtCO_2$ waveform.	

The purpose of this policy is to improve airway management safety and prevent the never event of unrecognized failed invasive airway.

POLICY

Indications: This clinical policy is intended for use for all patients where an invasive airway is utilized.

Airway Confirmation: All invasive airway placements must be confirmed with the use of in-line waveform capnography as defined by the standard above. If an invasive airway cannot be confirmed with waveform capnography, alternative methods of confirmation are ***not*** acceptable substitutes for this minimum standard. Absence of a sustained capnography tracing should be interpreted to mean that the endotracheal tube is in the esophagus ("No Trace, Wrong Place") and must be removed. A supraglottic airway device that cannot be confirmed with waveform capnography, even after repositioning, must be removed. Pulse oximetry may take minutes to drop, so a normal saturation should not be reassuring if there is not a sustained capnography waveform.

Use of waveform capnography with non-invasive ventilation: If equipped and able, waveform capnography should be used with face-mask ventilation (BVM) as it provides immediate feedback on the success of non-invasive ventilation and confirms functioning waveform capnography[11,12] and display prior to escalation to an advanced airway.

Airway Monitoring: Any invasive airway must be monitored on an ongoing basis to detect airway displacement immediately and ensure timely resumption of oxygenation and ventilation.

Documentation: An $EtCO_2$ value should be confirmed and documented immediately after placement, with patient movement, and at the time of patient handoff or termination of resuscitation. Monitor files should be attached to electronic PCRs to enable monitor file review.

Quality Management: Agencies should monitor all invasive airway placements to ensure adherence to this minimum standard. In the event of a patient safety event (unrecognized failed invasive airway) or near-miss (failure to use waveform capnography), a Just Culture approach should be used to understand the system and/or individual factors that led to the event and enable improvements in patient safety.

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