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Standards for Capnography

American Heart Association (AHA) Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, Part 8: Adult advanced cardiovascular life support 2010 Update

SUMMARY

The 2010 update of the American Heart Association's (AHA) adult advanced cardiovascular life support (ACLS) included a number of important changes to the 2005 ACLS guidelines. In addition to changes to the cardiac arrest algorithms and changes to drugs for therapies, this update includes the new recommendations for "continuous quantitative waveform capnography... for confirmation and monitoring of endotracheal tube placement" as well as a discussion of the potential value of end-tidal CO_2 as an indicator of the return of spontaneous circulation (ROSC) and as a tool to optimize CPR quality.

International Liaison Committee on Resuscitation conferences are periodically held to evaluate resuscitation science and generate conclusions and recommendations which are published as consensus science statements and treatment recommendations. This review of science and guidance documents has been occurring on a 5-year cycle. The most recent guidelines from the AHA[1] and European Resuscitation Council (ERC) (1)[2] resulted from the 2010 International Consensus Conference in February 2010 attended by 313 experts from 30 countries. (2) The recommendations for capnography with respect to adults may be found in the adult advanced cardiovascular life support sections of the AHA and ERC guidelines. Relevant portions of the AHA Part 8 guidelines are summarized.

1. CONTINUOUS WAVEFORM CAPNOGRAPHY FOR CONFIRMING AND MONITORING PLACEMENT OF ENDOTRACHEAL TUBE

The guideline notes that a number of past studies have documented the unacceptable high levels of unrecognized tube misplacement or displacement and the high risk of tube misplacement, displacement, as well as the need for additional confirmation of tube placement using waveform capnography.

Part 8.1 of the guideline "Adjuncts for Airway Control and Ventilation — Overview of Airway Management" indicates:

"Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube (Class I, Level of Evidence (LOE) A). Providers should observe a persistent capnographic waveform with ventilation to confirm and monitor endotracheal tube placement in the field, in the transport vehicle, on arrival at the hospital, and after any patient transfer to reduce the risk of unrecognized tube misplacement or displacement."

Continuous waveform capnography, recommended as a Class I LOE A[3] procedure (3), is the strongest classification available from the AHA. Such procedures are considered useful/effective and are backed up with "sufficient evidence from multiple randomized trials or meta-analysis." (4) In support of this, two studies (5,6) using waveform capnography of patients undergoing cardiac arrest with

[1] The AHA guidelines published as a supplement to Circulation (October 19, 2010, Volume 122, Issue 16 suppl 2) in 13 parts (approx. 400 pages) and included parts specific to adult basic life support, defibrillation, advanced life support, neonatal resuscitation and pediatric basic and advanced life support and is available on-line http://circ.ahajournals.org/content/122/16_suppl_2.toc.

[2] http://www.cprguidelines.eu/2010/

[3] Class I (indication of size of treatment effect) designation is the highest level with benefit greatly exceeds the risk and as such refers to a "procedure/treatment that should be performed/administered". An LOE (level of evidence) A indicates "data derived from multiple randomized clinical trials or meta-analysis".

[4] Class IIa Level B - recommends procedure as useful with some conflicting evidence from a single RCT or nonrandomized studies.

[5] Class IIb Level C - usefulness less established with possible diverging studies or opinion.

100% sensitivity and 100% specificity are cited. Additionally, the guideline notes that while capnography has not been studied for confirming and monitoring the correct placement of supraglottic airways, "effective ventilation through a supraglottic airway device should result in a capnographic waveform during CPR and after ROSC."

2. MONITORING ETCO$_2$ DURING CPR

The guideline discusses research which has shown that monitoring end-tidal CO_2 during CPR has the potential to:

(a) Guide individual optimization of compression depth and rate and to detect fatigue in the provider performing compressions. If end-tidal CO_2 is <10 mm Hg, it is reasonable to consider trying to improve CPR quality by optimizing chest compression parameters (Class IIb, LOE C).

(b) Serve as an indicator of ROSC by observing an abrupt sustained increase in end-tidal CO_2. If end-tidal CO_2 abruptly increases to a normal value (35 to 40 mm Hg), it is reasonable to consider that this is an indicator of ROSC (Class IIa, LOE B)[4].

(c) (In combination with) quantitative waveform capnography in intubated patients monitor CPR quality, optimize chest compressions, and detect ROSC during chest compressions or when rhythm check reveals an organized rhythm (Class IIb, LOE C)[5].

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