

### **Prognostication During CPR:End-Tidal CO<sub>2</sub> - Updated ALS 459 ALS 459**

The 2015 ILCOR systematic review considered one in-arrest modality, ET<sub>CO<sub>2</sub></sub> measurement, in prognosticating outcome from cardiac arrest. This section focuses on whether a specific ET<sub>CO<sub>2</sub></sub> threshold can reliably predict ROSC and survival or inform a decision to terminate resuscitation efforts. The potential value of using ET<sub>CO<sub>2</sub></sub> as a physiologic monitor to optimize resuscitation efforts is discussed elsewhere (See [Monitoring Physiologic Parameters During CPR, earlier in this Part](#)).

ET<sub>CO<sub>2</sub></sub> is the partial pressure of exhaled carbon dioxide at the end of expiration and is determined by CO<sub>2</sub> production, alveolar ventilation, and pulmonary blood flow. It is most reliably measured using waveform capnography, where the visualization of the actual CO<sub>2</sub> waveform during ventilation ensures accuracy of the measurement. During low-flow states with relatively fixed minute ventilation, pulmonary blood flow is the primary determinant of ET<sub>CO<sub>2</sub></sub>. During cardiac arrest, ET<sub>CO<sub>2</sub></sub> levels reflect the cardiac output generated by chest compression. Low ET<sub>CO<sub>2</sub></sub> values may reflect inadequate cardiac output, but ET<sub>CO<sub>2</sub></sub> levels can also be low as a result of bronchospasm, mucous plugging of the ETT, kinking of the ETT, alveolar fluid in the ETT, hyperventilation, sampling of an SGA, or an airway with an air leak. It is particularly important to recognize that all of the prognostication studies reviewed in this section included only intubated patients. In nonintubated patients (those with bag-mask ventilation or SGA), ET<sub>CO<sub>2</sub></sub> may not consistently reflect the true value, making the measurement less reliable as a prognostication tool.

5.5.1

### **2015 Evidence Summary**

Studies on the predictive capacity of ET<sub>CO<sub>2</sub></sub> among intubated patients during cardiac arrest resuscitation are observational, and none have investigated survival with intact neurologic outcome. An ET<sub>CO<sub>2</sub></sub> less than 10 mmHg immediately after intubation and 20 minutes after the initial resuscitation is associated with extremely poor chances for ROSC and survival.<sup>9,13,16,19,259</sup>

A prospective observational study of 127 IHCA patients found that an ET<sub>CO<sub>2</sub></sub> less than 10 mmHg at any point during the resuscitation was predictive of mortality, and only 1 patient with an ET<sub>CO<sub>2</sub></sub> value less than 10 mmHg survived to discharge.<sup>259</sup> In that same study, an ET<sub>CO<sub>2</sub></sub> greater than 20 mmHg after 20 minutes of resuscitation was associated with improved survival to discharge.<sup>259</sup> Another prospective observational study of 150 OHCA patients reported no survival to hospital admission when the ET<sub>CO<sub>2</sub></sub> was less than 10 mmHg after 20 minutes of resuscitation.<sup>9</sup> Although these results suggest that ET<sub>CO<sub>2</sub></sub> can be a valuable tool to predict futility during CPR, potential confounding reasons for a low ET<sub>CO<sub>2</sub></sub> as listed above and the relatively small numbers of patients in these studies suggest that the ET<sub>CO<sub>2</sub></sub> should not be used alone as an indication to terminate resuscitative efforts. However, the failure to achieve an ET<sub>CO<sub>2</sub></sub> greater than 10 mmHg despite optimized resuscitation efforts may be a valuable component of a multimodal approach to deciding when to terminate resuscitation.

There are no studies that assess the prognostic value of ET<sub>CO<sub>2</sub></sub> measurements sampled from an SGA or bag-mask airway in predicting outcomes from a cardiac arrest.

5.5.2

### **2015 Recommendations—New**

***In intubated patients, failure to achieve an ET<sub>CO<sub>2</sub></sub> of greater than 10 mm Hg by waveform capnography after 20 minutes of CPR may be considered as one component of a multimodal***

**approach to decide when to end resuscitative efforts, but it should not be used in isolation. (Class IIb, LOE C-LD)**

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The above recommendation is made with respect to ETCO<sub>2</sub> in patients who are intubated, because the studies examined included only those who were intubated.

***In nonintubated patients, a specific ETCO<sub>2</sub> cutoff value at any time during CPR should not be used as an indication to end resuscitative efforts. (Class III: Harm, LOE C-EO)***

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