Capnography during CPR

Carl Gwinnutt
Emeritus Consultant SRFT
Vice-Chair Resuscitation Council (UK)
Capnography during CPR

• Why capnography?
• What should be included?
• Does this meet the needs of Instructors and candidates?
• The final product
Capnography during CPR

• ERC guidelines for Resuscitation 2010 support the use of ETCO$_2$ monitoring in adults and children to provide information on:
  – the quality of chest compressions
  – return of spontaneous circulation
  – tracheal tube placement
  – normoventilation

• Summer 2012 survey of ALS Instructors, most popular changes:
  – waveform capnography
Capnography during CPR

What to teach?
1. Normal capnograph and what it represents
2. Demonstrate capnograph characteristics seen in cardiac arrest and during the peri-arrest period
3. Discuss these in relation to:
   - efficacy of CPR
   - ROSC
   - prognostication
   - tube placement
   - guide to ventilation
4. Use of capnography in both critically ill and cardiac arrest patients
Capnography during CPR

Learning outcomes

- To understand:
  - The nomenclature associated with monitoring expired carbon dioxide
  - The principles of how carbon dioxide is measured
  - The structure of the waveform in capnography
  - The uses of waveform capnography in resuscitation
  - Factors affecting end tidal carbon dioxide in critically ill patients
Typical waveform capnograph

Side-stream sampling

![Diagram showing a typical waveform capnograph with labels: Water trap, To ventilator, T-piece, To tracheal tube / SAD.](image)
The normal CO₂ waveform

A – B: The end of inspiration. The concentration of CO₂ is zero.

B – C: The start of expiration, with a rapid rise in the concentration of expired CO₂.

C – D: The alveolar plateau. This represents gas from alveoli taking part in gas exchange.

D: The end of expiration the concentration of CO₂ is maximal, the end tidal CO₂ (etCO₂).

D – E: Inspiration. Gas containing no CO₂ is mixed with a small amount of residual expired gas in the breathing circuit. This is rapidly diluted until gas containing no CO₂ is being inspired (E).
Capnography during CPR

1. Presence of CO$_2$ confirms tracheal tube in the airway
2. Fall in ETCO$_2$ shows reduced quality of chest compressions
3. Increase in ETCO$_2$ indicates ROSC
4. Respiratory rate 18 breaths min$^{-1}$
   ETCO$_2$ 3.0 kPa during CPR associated with good prognosis

Waveform capnography in critically ill patients

Ventilated patient, rate 12 breaths/min, Vt 500ml.
Low etCO₂ suggesting either low production of CO₂ or impaired delivery to the lungs
In this case, a patient with significant pulmonary embolism
Capnography during CPR
Feedback from pilot courses

• Instructors:
  – Too complicated for most ward-based candidates, too simple for anaesthetists
  – Question of relevance – what are we wanting candidates to achieve?
  – Not enough time
  – Need physical kit
  – A short discussion on capnography would be adequate
  – Possibly just focus on capnography in cardiac arrest

• Candidates:
  – How is capnography going to change my management within a cardiac arrest?
  – Waveform capnography not relevant to most team members

Average score for ARS 5.47 (ABGs 5.28, CasTeach 5.59)
Capnography during CPR

1. Waveform capnography as an appendix to the manual
Capnography during CPR

2. Add a slide of waveform capnography during cardiac arrest into ALS Algorithm lecture
Capnography during CPR

3. Include waveform capnography in Associated Resuscitation Skills: Airway Management

• Understand the indications for the use of waveform capnography
• Understand how to interpret waveform capnography
• Discuss capnograph characteristics seen in cardiac arrest in relation to:
  – efficacy of CPR
  – ROSC
  – tube placement
  – guide to ventilation
  – prognostication
Capnography during CPR

Summary:

• Waveform capnography is an important monitor during CPR
• ALS manual modified to include a detailed appendix
• ALS course modified *in response to feedback* to include its use during CPR:
  – ALS algorithm lecture
  – Associated Resuscitation Skills, Airway workshop