Clinical Practice Procedures:
Assessment/Waveform capnography

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Date	April, 2017
Purpose	To ensure a consistent procedural approach to Waveform capnography.
Scope	Applies to all QAS clinical staff.
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Information security	This document has been security classified using the Queensland Government Information Security Classification Framework (QGISCF) as UNCLASSIFIED and will be managed according to the requirements of the QGISF.
URL	https://ambulance.qld.gov.au/clinical.html

Waveform capnography

Waveform capnography is the continuous measurement of exhaled carbon dioxide (CO_2). This is displayed graphically as a capnogram (waveform) representing CO_2 throughout the respiratory cycle. End tidal CO_2 ($EtCO_2$) is the peak value at the end of each exhalation, and this is displayed numerically in mmHg.[1–3]

Measurement of $EtCO_2$ in patients with an advanced airway is an effective, non-invasive indicator of cardiac output during CPR, and may be an early indicator of ROSC.[4–5]

Capnography will provide objective evidence of breathing patterns and pre-empt any reduction in oxygen saturations. It provides real-time monitoring and readily detects apnoea or respiratory depression.[6]

Waveform $EtCO_2$ monitoring is mandatory to confirm ETT placement and throughout subsequent ventilation.[3,7]

At depths > 380 m (1250 ft) below sea level the LIFEPAK®12 waveform capnography is unable to be used due to mechanical error. In this setting (ie. underground mining operations such as Mt Isa) the corpuls3 is the mandatory alternative for confirmation of correct ETT placement.[3,7]

Indications

- CPR
- Sedation and procedural sedation
- Endotracheal intubation (placement confirmation)
- Ongoing monitoring of ventilation

Contraindications

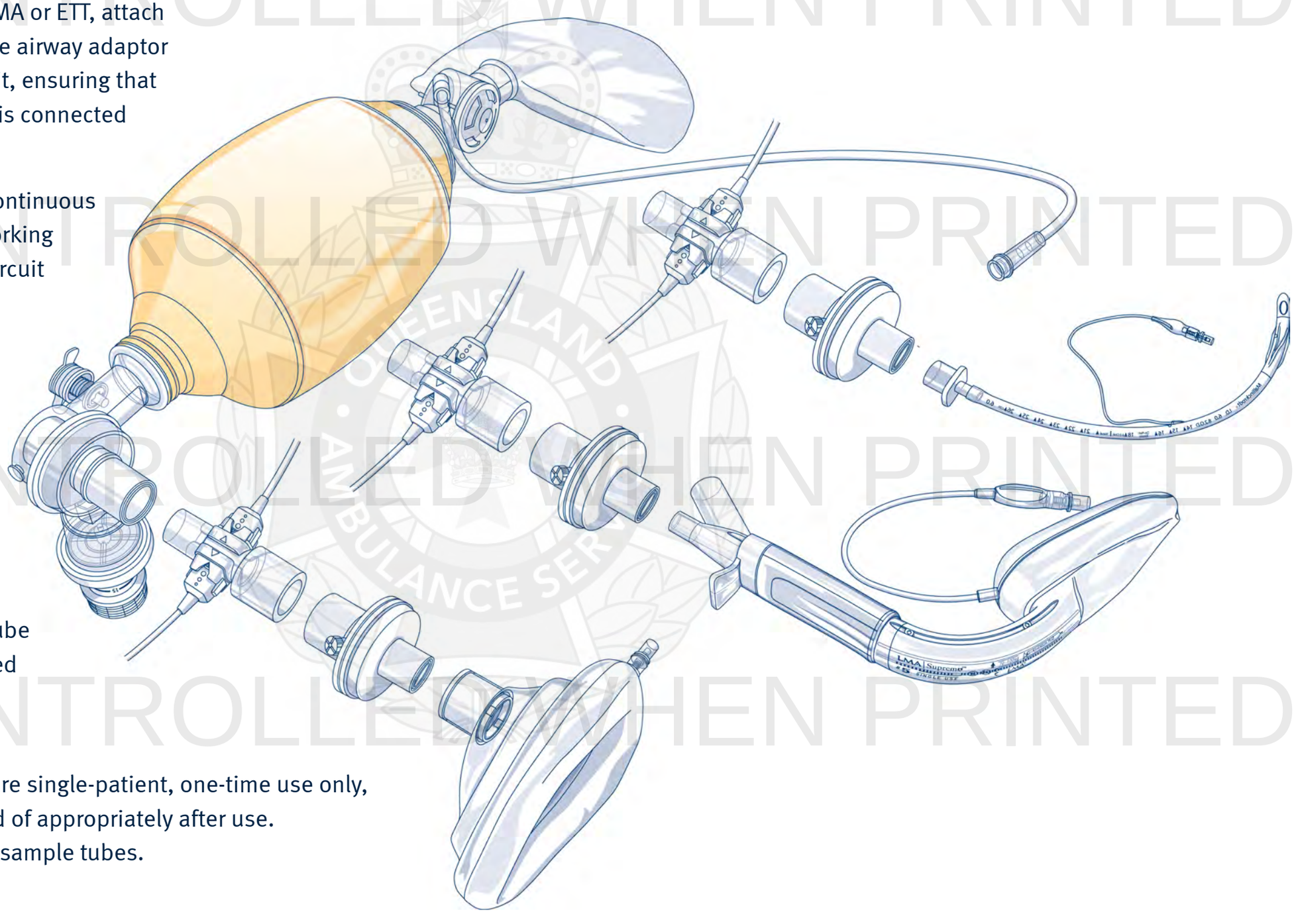
- Nil in this setting

Complications

- When performing effective CPR during cardiac arrest, $EtCO_2$ values are not to be used to vary IPPV from the recommended rate.[3]

Procedure for capnography monitoring[7]

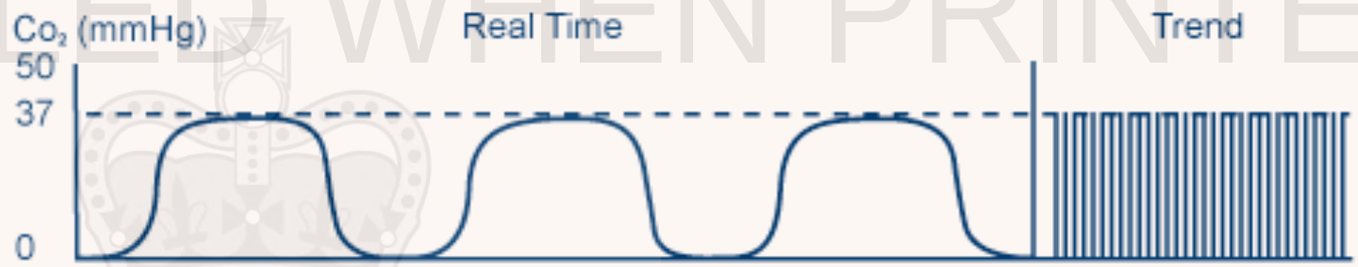
1. Open the CO_2 tubing connector door and connect the $EtCO_2$ sample tube by turning the tubing clockwise.
2. When using a BVM, LMA or ETT, attach the $EtCO_2$ sample tube airway adaptor to the breathing circuit, ensuring that a bacterial/viral filter is connected on the 'patient' side.
3. It is mandatory that continuous waveform $EtCO_2$ is working and included in the circuit prior to intubation.
4. Carefully route the $EtCO_2$ sample tube to avoid patient entanglement or strangulation.
5. Confirm capnography values are displayed.
6. If the $EtCO_2$ sample tube becomes contaminated or blocked, replace it immediately.
7. $EtCO_2$ sample tubes are single-patient, one-time use only, and must be disposed of appropriately after use. Do not clean or reuse sample tubes.



Additional information

- In cardiac arrest, tracheal placement of the ETT must be confirmed using capnography. If there is a complete absence of $EtCO_2$ (or if the capnography device becomes unserviceable) the ETT must be removed, and the failed intubation algorithm is to be commenced.[3,4]
- In non-cardiac arrest situations, tracheal placement of the ETT must be confirmed and monitored continually with capnography. If the capnograph indicates that tracheal placement cannot be confirmed, the ETT must be removed and the failed intubation drill is to be commenced.[4,6]
- In situations where IPPV is provided without an ETT, (i.e.when using a BVM or LMA), capnography is highly desirable and it should be connected as soon as other urgent priorities allow.[7]
- QAS clinicians must be familiar with the operating instructions, with particular attention to warnings, alarms and troubleshooting.

Normal capnography



A normal capnograph is present when the patient:

- is spontaneously breathing or adequately ventilated
- has normal cardiac output
- has normal metabolic function

Endotracheal tube in the oesophagus

Oesophageal intubation may be confirmed by:

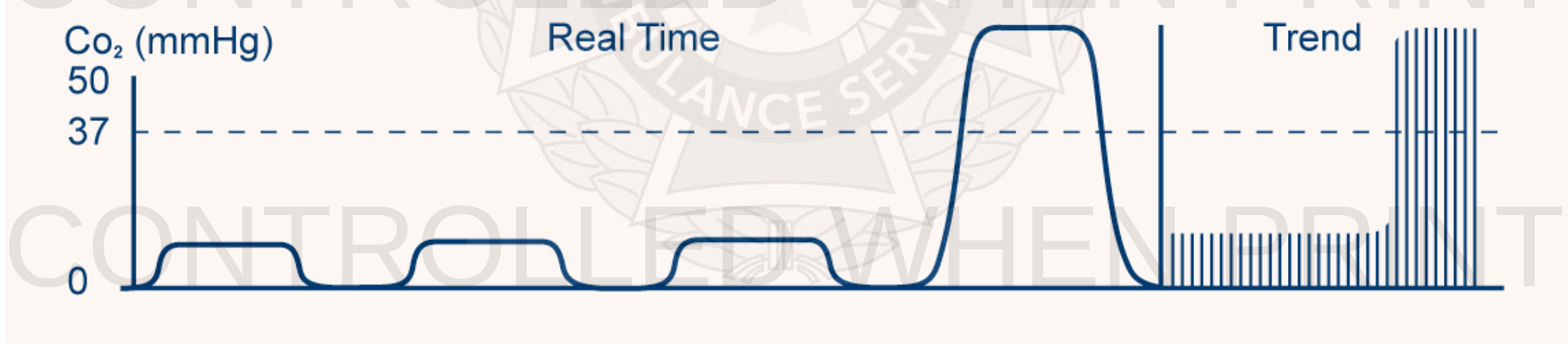
- an absence of waveform and EtCO2
- small transient diminishing waveforms

Reduced $EtCO_2$ levels

Possible causes:

- shock
- pulmonary embolus
- effective CPR being performed during cardiac arrest

Sudden significant increase in $EtCO_2$



Possible causes:

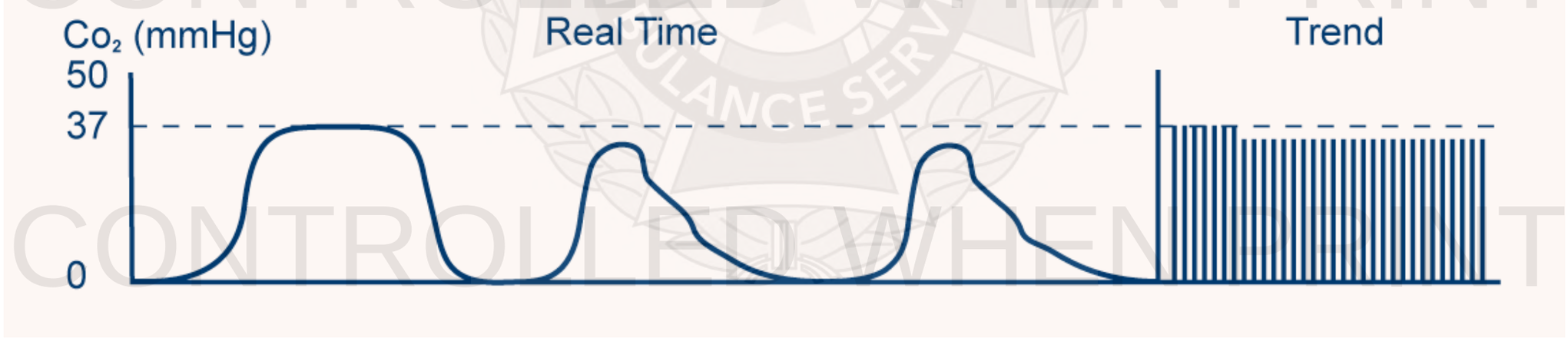
- return of spontaneous circulation

Absent $EtCO_2$ levels and waveform

Possible causes:

- no metabolic activity
- no CPR in cardiac arrest
- exsanguination / profound shock
- equipment failure
- apnoea
- airway obstruction
- oesophageal placement

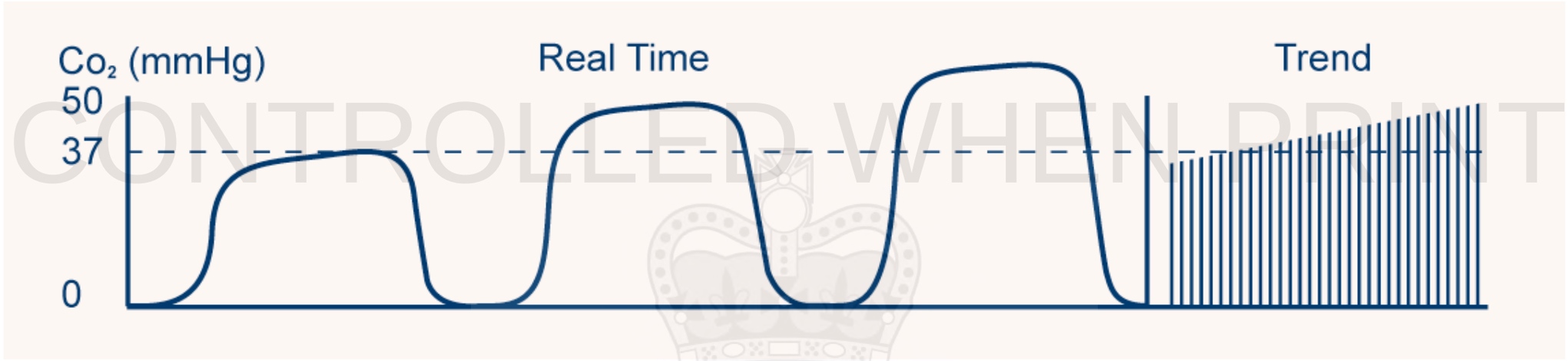
Inadequate seal around endotracheal tube



Possible causes:

- a leaky or deflated endotracheal or tracheostomy cuff
- an artificial airway that is too small for the patient

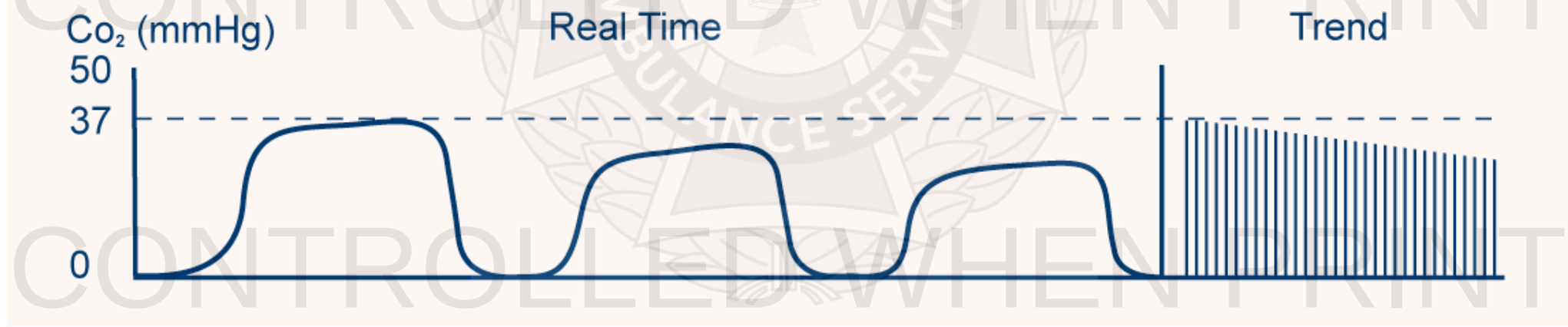
Increased $EtCO_2$ levels from normal



Possible causes:

- respiratory depression/failure
- inadequate respiratory rate and/or tidal volume
- increased CO_2 production through increased metabolic rate or temperature or reperfusion of ischaemic tissue

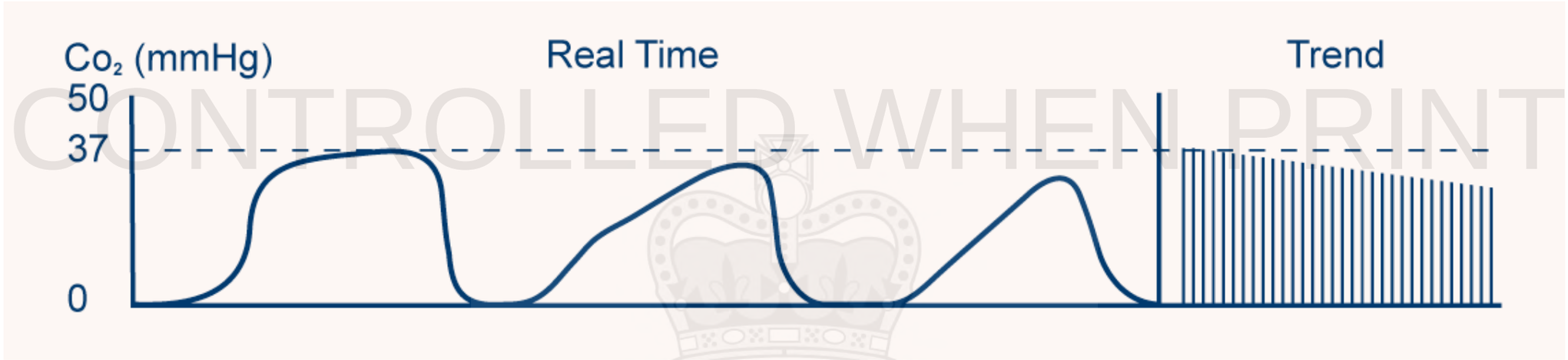
Decreased $EtCO_2$ levels from normal



Possible causes:

- inadequate respiratory rate and/or tidal volume
- diminished CO_2 production through decreased metabolic rate
- falling cardiac output

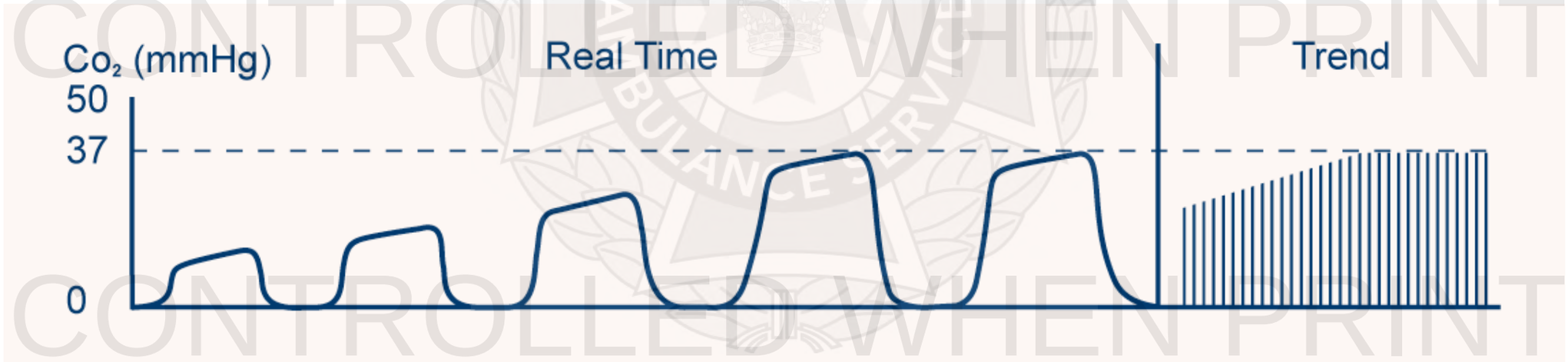
Obstruction in breathing circuit or airway



Possible causes:

- obstruction in the expiratory breathing circuit
- presence of a foreign body in upper airway
- partially kinked or occluded artificial airway
- bronchospasm

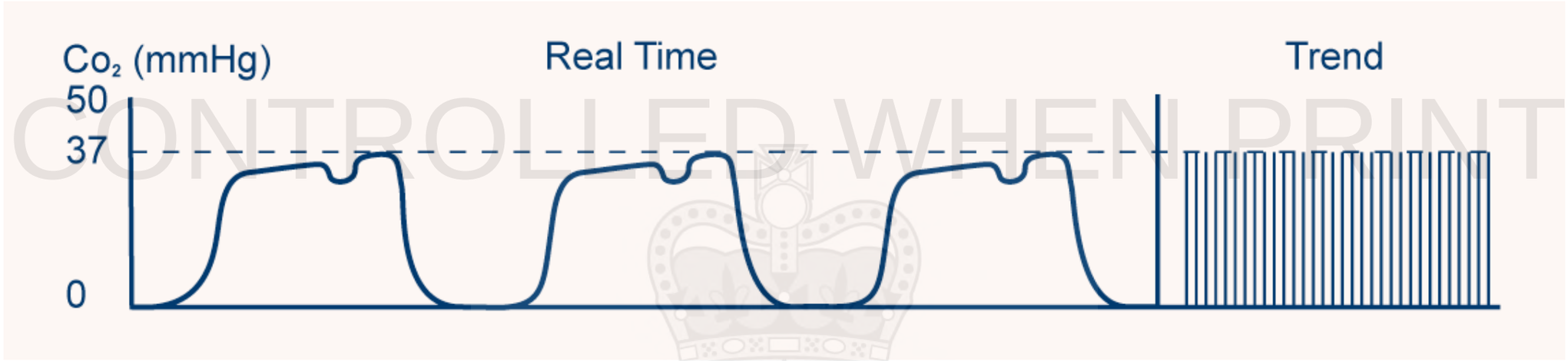
Increased $EtCO_2$ values towards normal



Possible causes:

- restoration of normal respiratory rate and/or tidal volume
- cardiac output improved
- improved integrity of airway seal (BVM/LMA/ETT)

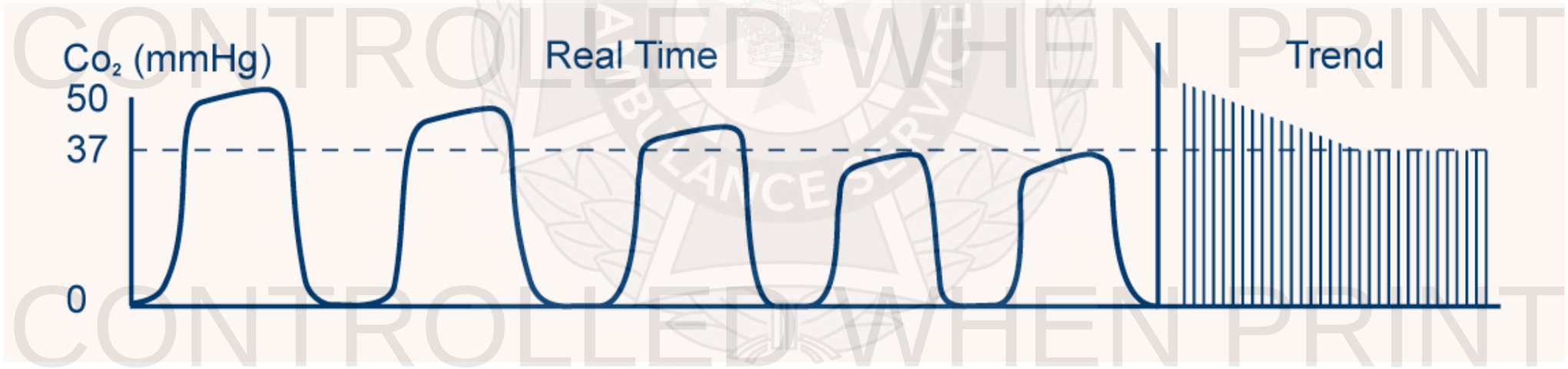
Curare cleft



Possible causes:

- inadequate or 'lightening' of paralysis

Decreasing $EtCO_2$ levels towards normal



Possible causes:

- restoration of normal metabolism/CO_2 production
- normalised respiratory rate and/or tidal volume