



A baseline clinical audit examining the measurement of ETCO₂ during advanced airway management of cardiac arrest patients by the London Ambulance Service

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Authors: Georgina Harrison and Frances Sheridan, Clinical Audit & Research Unit
Clinical Advisors: Tim Edwards, Mark Whitbread and Joanne Smith

Introduction

When a patient experiences a cardiac arrest, it is important that a patient's airway is secured as this will enable the practitioner caring for the patient to perform continuous chest compressions, without the need to pause for ventilation (JRCALC, 2006). An airway should be secured using an advanced airway adjunct; these adjuncts include endotracheal tubes (ET) and supraglottic airway devices (SGA), such as a Laryngeal Mask Airway and i-Gel.

Due to the reduced number of hospital placements, in June 2010 ET intubation was taken out of the paramedic course curriculum, so only Paramedics trained prior to this date are able to intubate. Therefore, consideration should be given to the use of a SGA as the first line management by all trained staff when providing an advanced airway. SGAs can be placed by all Paramedics and Emergency Medical Technician (EMT) 4s (and EMT 3s who have undertaken the advanced airway management course).

End-tidal carbon dioxide (ETCO₂) readings should be monitored for all patients where an advanced airway adjunct is used. ETCO₂ readings allow the ambulance crew to monitor the patient's respiratory status and can help to confirm correct placement of an adjunct. ETCO₂ is also an effective monitor of chest compressions.

If intubation is used to achieve control of the patient's airway, it is best practice for Paramedics to use ETCO₂ monitoring to ensure that the tube has been correctly placed in the trachea, and not in the patient's oesophagus. Carbon dioxide is not present in the oesophagus, therefore if the ETCO₂ reading is not above 10 mmHg during cardiac arrest and chest compressions are underway, the quality of the chest compressions should be reviewed as well as the placement of the tube. By frequently assessing the ETCO₂ reading, a Paramedic is able to evidence the continued correct placement of the ET. It is especially important for a Paramedic to recheck the ETCO₂ reading after moving the patient, as doing so may cause the tube to be displaced. In 2010, the UK Resuscitation Council advised that waveform capnography was the most sensitive way to confirm and monitor the position of a tracheal tube in a cardiac arrest patient.

When a patient is intubated or a SGA is placed, the attending member of ambulance crew should document the ETCO₂ measurement on the Patient Report Form (PRF) and attach a print out of the corresponding wave form to provide evidence of the care given to the patient for the clinical record.

This baseline clinical audit was conducted to assess if ETCO₂ measures and wave forms are being used consistently in the London Ambulance Service NHS Trust (LAS) to inform the care given to patients where an advanced airway adjunct is used, and if they are not, to make recommendations to improve care.

Method

PRFs for 50 consecutive patients who had an advanced airway adjunct placed in the last week in June 2011 were audited against standards derived from national and international clinical practice guidelines and LAS information circulars.

Data from the LAS Cardiac Arrest database was used to identify patients who had an advanced airway adjunct placed. The PRFs for each case were used to analyse compliance to clinical audit standards (Table 1). The PRF relating to the crew member who placed the airway was used to collect the data. Six cases were reviewed by a Clinical Advisor. Cases were excluded if: the advanced airway adjunct was not placed by the LAS, or if a PRF was missing. Where more than one airway adjunct was attempted, data collected related to the final method used to maintain the patient's airway.

Adherence to the following clinical audit standards of care was measured:

| Aspect of care | Target | Exceptions | Definitions and Instructions |
|--|--------|--|---|
| ETCO ₂ reading documented on the PRF. | 100% | ETCO ₂ equipment failure. | American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2010); Resuscitation Guidelines – Resuscitation Council (UK) (October 2010); London Ambulance Service NHS Trust Cardiac Care Information (2010); Emergency care in the streets (6 th ed.) (Caroline, 2008). |
| If ETCO ₂ reading is zero, adjunct is removed and placement retried. | 100% | Previous ETCO ₂ reading documented and the patient went in to cardiac arrest. | American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2010); Resuscitation Guidelines – Resuscitation Council (UK) (October 2010); Emergency care in the streets (6 th ed.) (Caroline, 2008). |
| Waveform submitted and attached to the corresponding PRF. | 100% | ETCO ₂ equipment failure. | American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2010); Resuscitation Guidelines – Resuscitation Council (UK) (October 2010); Emergency care in the streets (6 th ed.) (Caroline, 2008); Airway Management – London Ambulance Service (2009). |
| Waveform compatible with tracheal intubation or lung ventilation via LMA (usually box shaped). | 100% | Waveform not submitted due to ETCO ₂ equipment failure. | American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2010); Resuscitation Guidelines – Resuscitation Council (UK) (October 2010). |

Table 1: Clinical audit standards of care

Results

One patient did not have their age or gender documented on the PRF. The age of the remaining patients in the sample ranged from 20 to 96 years old. The median age of patients in the sample was 74 years. Most patients in the sample were male (57% (n=28), female 43% (n=21)). All patients in the sample were in cardiac arrest.

Thirty six patients had an ET placed (72%) and 14 patients had an SGA placed (28%). Twelve of the SGAs were placed by Paramedics (86%) and two were placed by Level 3 Emergency Medical Technicians (EMTs) (14%)¹.

In one case ETCO₂ equipment failed, therefore the ambulance crew were not able to document an ETCO₂ reading. An ETCO₂ reading was documented for 42 of the remaining 49 patients (86%). There was no ETCO₂ reading documented for seven patients (14%).

Two ETCO₂ readings were documented for 16 (33%) patients. An ETCO₂ reading was documented in the crews initial set of observations (following insertion of an advanced airway adjunct), without a subsequent reading documented in the second set of observations for four patients (8%). There was an ETCO₂ reading documented in only the second set of observations taken by the ambulance crew, and not the initial set, for 22 patients (45%).

In the one case where ETCO₂ equipment failed, the ambulance crew were not able to print and submit a waveform corresponding to an ETCO₂ reading for the patient. Two of the remaining 49 PRFs (4%) had a waveform attached. Both of these waveforms were box shaped. Therefore it was not necessary for the ambulance crew to re-try the placement of the airway adjunct. A waveform was not attached to PRFs for 47 patients (96%). In two cases the crew documented in the PRF free text box that the waveform was box-shaped, however it was not attached.

Where an ETCO₂ reading was documented, this reading was not zero for any patients.

Summary

The clinical audit found that an SGA was used to maintain the patient's airway for just over a quarter of patients in the sample. When an SGA was used, the majority of these were placed by Paramedics, indicating that staff are beginning to take on board the recommendations made by the LAS in 2010, stating that an SGA should be viewed as the preferential method for maintaining a patient's airway.

At least one ETCO₂ reading was documented for the majority of patients. ETCO₂ readings were documented more frequently in the ambulance crews' second set of observations than immediately following insertion of an advanced airway adjunct in their initial set of observations. Ambulance crews should aim to document at least two ETCO₂ readings on the PRF as this demonstrates that the crew have assessed the patients ETCO₂ to ensure continuous correct placement of the airway adjunct.

Very few waveforms were attached as part of the clinical record with the corresponding PRF, demonstrating room for improvement in this area. It is important to print off an ETCO₂ waveform and document its corresponding CAD number as this provides evidence of the care provided for the patient and forms part of the complete clinical record. This should then be sent to Management Information for scanning along with the PRF.

¹ EMTs are able to place SGAs following the completion of their advanced airway management course. This means that occasionally Level 3 EMTs place SGAs.

Recommendations and Actions

| Recommendation Number | Recommendation | Action/ Means | Responsibility | Deadline |
|-----------------------|--|---|--|--|
| 1 | The LAS should increase the number of waveforms that are included in the electronic clinical record for this patient group. | <p>CARU should produce poster to display on stations communicating the findings of this clinical audit and reminding them of the importance submitting a labelled waveform with the corresponding CAD number when an ETCO₂ reading is taken.</p> <p>Station Administrators should be reminded that waveforms are sent to Management Information with the associated PRF.</p> <p>Management Information should ensure that wave forms are scanned as part of the clinical record.</p> | <p>Head of Clinical Audit and Research Unit, Rachael Donohoe.</p> <p>Head of Clinical Audit and Research Unit, Rachael Donohoe.</p> <p>Management Information Manager, Sue Meehan.</p> | <p>March 2012.</p> <p>March 2012.</p> <p>April 2012.</p> |
| 2 | Crews should be reminded of the 2010 LAS Medical Bulletin outlining the preferential use of an SGA, emphasising that it is a safe and effective way of maintaining a patient's airway. | <p>CARU should write an article for the Clinical Update reminding crews that an SGA is currently the preferential advanced airway adjunct for pre-hospital care.</p> <p>Review Advanced Life Support in the Core Skills Refresher 1 training should include particular emphasis on the preferential use of SGA's and including waveform print outs in the patient's clinical record.</p> | <p>Head of Clinical Audit and Research Unit, Rachael Donohoe.</p> <p>Assistant Director of Professional Education and Development, Gill Heuchan.</p> | <p>March 2012.</p> <p>April 2012.</p> |

Table 2: Recommendations and actions for improvement to the care provide to patients who are at the end-stage of their terminal illness

References

American Heart Association. Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. 2010.

Caroline, N. (2008) Emergency Care in the Streets, 6th edition, London: Jones and Bartlett Publishers.

Joint Royal Colleges Ambulance Liaison Committee Clinical Practice Guidelines for use in UK Ambulance Services. Adult Advanced Life Support. 2006.

London Ambulance Service NHS Trust. Cardiac Care Information Circular 007. 2010.

London Ambulance Service NHS Trust. Airway Management (Clinical Education & Development Course Material). 2009.

Resuscitation Council (UK). Resuscitation Guidelines. 2010.

Costing Table

Table 2 shows a breakdown of the approximate cost of this clinical audit project. Cost analysis is reported to provide the Service with an understanding of the resources involved in conducting this clinical audit project.

| Staff costs | | | |
|---|------------------------|-----------------|-------------------------|
| Description of staff activity | Number of hours | Pay Band | Approximate Cost |
| Project set-up | 2 | 6 | £30 |
| Project design | 2 | 4 | £20 |
| Project design | 1 | 6 | £15 |
| Project design | 1 | 7 | £18 |
| Data collection | 1 | 4 | £10 |
| Data Entry/Quality Assurance/Double Pilot | 5 | 4 | £50 |
| Data Entry/Quality Assurance/Double Pilot | 3 | 5 | £36 |
| Clinical review/advice | 1 | 7 | £18 |
| Data analysis | 2 | 4 | £20 |
| Report write up | 6 | 4 | £60 |
| Report write up | 8 | 5 | £96 |
| Feedback on report | 1 | 6 | £15 |
| Feedback on report | 1 | 7 | £18 |
| Report re-drafting | 10 | 5 | £120 |
| Report re-drafting | 1 | 6 | £15 |
| Total | | | £541 |

Table 3: Cost analysis for this clinical audit project