Why do I intubate cardiac arrest victims?

Scott Griera, Matthew Thomas

Great Western Air Ambulance, Bristol, UK
Intensive Care Unit, Bristol Royal Infirmary, Bristol, UK

Abstract

Pre-hospital airway management of cardiac arrest patients is an area of great controversy. In this opinion piece, we explore the reasons behind our belief that all patients suffering an out-of-hospital cardiac arrest should undergo endotracheal intubation. A review of current practice and guidelines suggests that endotracheal intubation should be performed by appropriately trained practitioners working within a specialised team that is adequately resourced and governed. The potential benefits of intubation, along with suggestions of how it should be delivered and by whom are described.

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1. Introduction

Out-of-hospital cardiac arrest is a common event, leading to significant morbidity and mortality. Each patient demands large amounts of resources from the emergency medical services, emergency department and intensive care unit in the receiving hospital. Despite these facts, relatively little is known about the optimal management of cardiac arrest patients, with differing opinions on airway management, delivery of ventilation, chest compressions and drug usage. Research is currently underway to begin to address the many unanswered questions [1,2], and the International Liaison Committee on Resuscitation (ILCOR) reviews the literature and updates its guidelines every five years based on the latest available evidence. This has seen significant changes in advanced life support guidelines for the management of cardiac arrest over the past ten years [3–5].

Airway management during and post-cardiac arrest has been the subject of a number of papers in recent years [6,7], but no clear consensus currently exists. As we approach the latest revision of the ILCOR guidelines [8], discussion once again turns to the choice of airway – basic adjuncts with bag-valve-mask, supraglottic airway device (SAD) or endotracheal intubation (ETI). Intubation has long been regarded as the ‘gold standard’ of airway management in these patients, but is fraught with problems [10]. There remains much debate about whether there is sufficient evidence to truly refer to it as a ‘gold standard’ – perhaps it has become regarded as such simply because we believe it should [11]. As survival rates from out-of-hospital cardiac arrest continue to increase [12,13], the factors involved in this trend are being sought; advanced airway management being one.

This opinion article outlines why we believe that all out-of-hospital cardiac arrest patients should be intubated by an appropriately trained individual using appropriate equipment and working within an emergency medical system with strict clinical governance and peer review.

2. Background to the controversy

In the United Kingdom, the overwhelming majority of out-of-hospital cardiac arrest patients are attended to by paramedics from regional emergency medical services. These medical professionals have their scope of practice defined by the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) guidelines. In 2008, JRCALC reviewed its stance on paramedic intubation in the UK [14] based on its conclusion that the required training (25 intubations performed in-hospital and no ongoing practice) was inadequate and that the advent and availability of SGA devices altered the need for intubation. The JRCALC group concluded that “tracheal intubation without the use of drugs has little value in prehospital practice” [14]. They also stated that ETI should be a “specialist skill for selected providers” and that “very significant improvements in initial and ongoing training and education would be required to develop this ... autonomous specialist skill”.

The College of Paramedics in the United Kingdom presented its own position statement following the JRCALC document [15].
challenging the review of evidence performed by JRCALC. The main objections concerned the fact that the JRCALC objections were centred around drug-assisted intubation, rather than the non-drug assisted intubation practiced by UK paramedics, and that the standards applied to paramedics required certain equipment that was freely available in hospital but not in UK emergency medical services [15].

It is clear, therefore, that even within one developed country, two supposedly allied organisations offer very different perspectives on the use of advanced airway management in the pre-hospital environment by paramedics. The provision of physician-delivered care in the United Kingdom is relatively limited and there are significant regional variations [16] with respect to availability and skillset. Both factors lead to a great deal of inconsistency across the country. Tasking of units that are staffed with physicians is also variable, so there is little guarantee of physician-led airway management in out-of-hospital cardiac arrest.

3. The benefits of endotracheal intubation

Endotracheal intubation in cardiac arrest has a number of perceived benefits when performed safely.

Once placed and the cuff inflated, effective ventilation of the patient’s lungs can be achieved, particularly when lung and/or chest wall compliance is poor. The leak pressures of SADs compared with endotracheal tubes are lower [17] and, given the thoracic wall dynamics during chest compressions, airway leak is almost certain with SADs.

The passage of ventilatory gas into the trachea without leak and insufflation of the oesophagus minimizes gastric inflation. This reduces the risk of regurgitation and aspiration of gastric contents, a risk further reduced by the cuff of the endotracheal tube.

One of the few interventions in cardiac arrest associated with improved outcomes is the delivery of good quality uninterrupted chest compressions. Endotracheal intubation, once achieved, allows the asynchronous performance of both chest compressions (at 100—120 per minute) and ventilation. In comparison to ventilation with a SAD (in a ratio of 30 compressions to 2 breaths), this increases the number of chest compressions delivered each minute, and reduces the pauses in compressions [18].

Despite the abovementioned perceived benefits of ETI, there is little evidence to suggest that overall outcome from out-of-hospital cardiac arrest is influenced by choice of airway, simply that earlier airway management, regardless of arrest rhythm or airway device, is associated with improved neurological outcomes [6].

4. What does the evidence tell us?

This article is not a review of all the evidence available, there are a number of recent papers attempting both a systematic review and meta-analyses [23,24].

Interestingly they frequently come up with contradictory conclusions. Almost all of these studies have used large retrospective registries usually from a single country. There appear to be differences between analyses with regard to what is a successful technique. The reasons why this is so are unclear but could be due to geographical and service organisation differences.

In countries with high population densities and short transit times basic airways appear better, however if transit times are prolonged then advanced airways seem better. This would support the requirement for a prospective randomised, controlled trial. It would also support regional pre-hospital services designing systems that suit their geography and patient populations.

The authors of this paper work for a physician staffed air ambulance operating in a UK city with a metro population of 1 million. It is very likely that the optimum system for cardiac arrest will differ according to distances and resources available.

5. Who should perform endotracheal intubation?

Endotracheal intubation is a skill that has been taught to UK paramedics for around 30 years. In 2008, a JRCALC position paper suggested that the training delivered to paramedics, and the lack of ongoing training, meant that endotracheal intubation should not be performed by ‘regular’ paramedics. A number of papers have examined in detail the success rates of pre-hospital critical care services in pre-hospital intubation practices [10,11] and several have compared the success rates of physician and non-physician practitioners [9].

In our opinion, endotracheal intubation in out-of-hospital cardiac arrest should be delivered as part of a group of interventions by an appropriately trained and resourced team.

Training in pre-hospital intubation should consist of both in-hospital intubation practice and experience, and pre-hospital simulation and real patient intubation. It is difficult to specify either the number of procedures required to obtain competency or the number performed per year to maintain it.

The best evidence to date suggests that 57 intubations are required to achieve a >90% competence. This is clearly far more than is currently achieved by front line paramedics [25].

The ‘average’ emergency medical service paramedic in the UK will see under five [19] out-of-hospital cardiac arrests a year, and in some regions far fewer than this. It is not surprising, therefore, that there is a significant complication rate associated with paramedic delivered pre-hospital intubation [10,11]. Lyon et al. analysed 794 pre-hospital intubations in Scotland and found that 7% involved significant complications including requiring greater than 3 intubation attempts, unrecognised oesophageal intubation, tube displacement and endobronchial intubation [11]. Overall intubation success rates for paramedics have been described across the range from 70% to 94% [10]. The morbidity and potential mortality of these complications is high, further lending weight to this skill not being universally offered.

Given the above evidence, it is clear that intubation may be seen as an advanced and specialist skill. Adequate training, regular exposure to the procedure in real patients, and maintenance of competency are key to success within an appropriate emergency medical system. It is our opinion that all patients requiring endotracheal intubation in out-of-hospital cardiac arrest should have this procedure undertaken by an advanced paramedic or physician working within a system that has specific tasking to these patients and on-going high quality training.

6. How should intubation during cardiac arrest be performed?

Endotracheal intubation delivered outside the hospital should be performed to the same standard as it would be inside the hospital. In addition, there are several factors relevant specifically to out-of-hospital cardiac arrest that are important to consider. The team and specialists delivering pre-hospital intubation should be adequately resourced with appropriate equipment and monitoring. Minimal levels of equipment should include laryngoscopes and a selection of blades, appropriately sized endotracheal tubes, gum elastic (or similar) bougie, alternative airways (oropharyngeal, nasopharyngeal and SGA) and both analogue and digital methods of confirming correct tube placement.

In addition to equipment and monitoring, the team should be well-versed in optimal cardiac arrest management, including the delivery of high-quality chest compressions (either manually or by
mechanical device) and minimising interruptions to these once commenced. Intubation with ongoing chest compressions is possible with minimal interruption to compressions when practiced and briefed beforehand. We have found that interruption can be kept to a minimum using a two-person team (intubator plus assistant) in communication with the cardiac arrest team leader and person delivering compressions or controlling the mechanical device.

Intubation should be performed in such a way as to maximise the first-pass success. Factors include positioning the patient (often more challenging in cardiac arrest), adequate preparation of equipment, positioning of the intubator, lighting and the use of a gum elastic (or similar) bougie. It has become widely accepted in pre-hospital physician-led care that intubation, even when good quality views are obtained, should be performed with a bougie.

Endotracheal tube position should be confirmed using both manual and electronic methods. Ideally the tube should be visualised passing through the vocal cords, bilateral breath sounds should be auscultated and end-tidal carbon dioxide should be confirmed with both colourimetric (eg. Nellcor™ Easycap [20]) and waveform capnography. Electronic capnography measurement is essential to the confirmation of tube position and, in our opinion, intubation should not be attempted unless it is available.

Practitioners performing pre-hospital intubation for out-of-hospital cardiac arrest should be practicing as part of an advanced care team which is specifically tasked to these patients. This team should have a dedicated dispatch process to identify early those patients most in need. As part of maintaining high standards and delivering optimal care, a strict clinical governance structure should exist, including review of pre-hospital intubations performed and problems or failures encountered. Each unit should have an accepted method of maintaining skill retention — either through clinical exposure, or if numbers do not permit, hospital theatre time to ensure skill levels are kept high [21].

7. Where does endotracheal intubation fit within current guidelines?

Endotracheal intubation during cardiac arrest has been recommended by the ILCOR and national guidelines (eg. Resuscitation Council UK [21] and American Heart Association [5]) for several iterations of the guidelines. In 2010, modifications were made to broaden options for airway management to either SAD or endotracheal tube [22].

The use of quantitative, waveform, capnography was recommended as the most reliable method of confirming tube placement, with high specificity and sensitivity [22]. The driving force behind this recommendation was the previously reported unacceptably high rate of unrecognised endotracheal tube misplacement.

In 2015, ILCOR are currently undergoing a consultation and evidence review process [8] before publication of the most recent guidelines in October 2015. Two areas of interest are the choice of advanced airway — SAD compared with ETI, and the timing of insertion of this advanced airway and its impact upon overall survival and neurological outcome.

8. Outstanding questions and the future

Over the coming years, a number of trials and guidelines are due to publish their findings covering the area of airway management in cardiac arrest. The aforementioned ILCOR 2015 guidelines and national derivatives will influence direction for the coming five years. A pre-hospital trial comparing the clinical and cost effectiveness of the iGel SAD and endotracheal intubation is about to start recruiting, although results are not expected until the end of the decade [2].

Determining the most appropriate advanced airway for each patient will prove a complex question to answer. The perceived benefits of endotracheal intubation may not be as great as believed, intubation success and failure rates may be altered with greater use of videolaryngoscopes and specialised practitioners.

The timing of advanced airway management within the whole out-of-hospital cardiac arrest journey is currently unknown. It is becoming increasingly evident that each element of cardiac arrest management requires optimising. For instance, there may be little point in inserting an advanced airway if no attention is made to ventilation, such as avoiding hyperventilation and large tidal volumes. Clearly greater research in this field is required, but some questions may prove impossible to answer.

9. Conclusions

The choice of airway for out-of-hospital cardiac arrest patients remains controversial. We have presented our opinion that all out-of-hospital cardiac arrest patients should be intubated by an experienced practitioner working within a specialised team that has specific training, equipment and governance.

Until the evidence points in one particular direction, we would simply ask ‘what would you want if it was you?’

Conflict of interest statement

Matthew Thomas is a regional investigator in the Airways-2 trial.

Scott Grier has no conflicts of interest to declare.

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None?

References


