

A Critical Reassessment of Ambulance Service Airway Management in Pre-Hospital Care

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1. Executive Summary

Paramedic tracheal intubation has been practiced in the UK for more than 20 years and is currently a core skill for paramedics. Growing evidence suggests that tracheal intubation is not the optimal method of airway management by paramedics and may be detrimental to patient outcome. There is also evidence that the current initial training of 25 intubations performed in-hospital is inadequate and that the lack of ongoing intubation practice may compound this further. Supraglottic airway devices (SADs; e.g. laryngeal mask airway), that were not available when extended training and paramedic intubation was first introduced, are now in use in many ambulance services and are a suitable alternative pre-hospital airway device for paramedics.

SUMMARY AND RECOMMENDATIONS

There is a paucity of evidence to suggest that tracheal intubation without the use of drugs is of patient benefit or improves outcome. The weight of evidence suggests that pre-hospital intubation without the use of drugs can worsen patient outcome.

The group believes that tracheal intubation without the use of drugs has little value in pre-hospital practice.

The current format of paramedic training is inadequate for training pre-hospital intubation. Improving training for all paramedics (and other similar providers) is not considered feasible, both for operational reasons and difficulties in delivering the training. The majority of those managing patients' airways in the pre-hospital setting should be trained to insert a supraglottic airway device instead of a tracheal tube. Tracheal intubation should be developed as a specialist skill for selected providers and should include the provision of drug-assisted intubation. Very significant improvements in initial and ongoing training and education would be required to develop this as an autonomous specialist skill.

Supraglottic airway devices have been shown to be safe and effective devices in elective and emergency hospital procedures. Their use in airway management in pre-hospital care is increasing and evidence suggests that they are suitable alternatives to tracheal intubation.

Training in the use of supraglottic airway devices is already mandatory for UK paramedic registration. Ambulance trusts should be encouraged to adopt and use these devices as an alternative to tracheal intubation.

Where ventilation proves impossible, particularly when there is a history of possible choking, and other manual techniques have failed, laryngoscopy may be used to attempt to remove any foreign body. This does not require training in laryngoscopy to the same extent as that necessary for tracheal intubation and can be incorporated within the current clinical airway management training.

When pre-hospital tracheal intubation is undertaken, the following should apply:

1. A gum elastic bougie should be available routinely.
2. Correct position of the tracheal tube must be verified using both a stethoscope and carbon dioxide detector. (Caution should be exercised when measuring and interpreting exhaled CO₂ during low cardiac output states such as cardiac arrest).

Our conclusions are consistent with the recent NCEPOD report (Trauma: Who cares? NCEPOD 2007) that states “*Airway management in trauma patients is often challenging. The pre-hospital response for these patients should include someone with the skill to secure the airway (including the use of rapid sequence intubation) and maintain adequate ventilation*”.

2. Introduction

Although some ambulance personnel were practicing tracheal intubation as early as 1968, intubation skills were first widely introduced into paramedic practice in the mid 1980s and are now a core component of the paramedic curriculum. The aim of introducing this skill to the pre-hospital environment was to provide patients with what was thought at the time to be optimal airway management. Subsequently, tracheal intubation has become expounded as a 'gold standard' in airway care.

Intubation training has traditionally been undertaken by paramedics on hospital attachments and there was generally no difficulty in obtaining adequate practical experience in the skill. As paramedics matured professionally and evidence-based practice was introduced into ambulance care, the benefits of intubation began to be questioned. This was reflected in the 'Joint Recommendation from AETAG/JRCALC Airway Group', published in November 2004.¹ More recently, the initial training requiring 25 intubations has become more difficult to provide; fewer patients undergoing general anaesthesia require tracheal intubation as the use of supraglottic airway devices (SADs) has become more widespread and concerns over patient consent raised by the Association of Anaesthetists of Great Britain and Ireland (AAGBI)² has resulted in fewer intubation opportunities in most hospitals. For paramedics who are qualified, ongoing competence has also been questioned; most paramedics undertake tracheal intubation relatively rarely, with figures ranging from an average of 2 per paramedic per annum in the former Avon Ambulance Service³ to just 1 per paramedic per annum in South Central Ambulance Service (Hampshire Division).⁴ The benefits of tracheal intubation, particularly in light of recent evidence,^{5,6} the difficulties in training in this procedure and the recent availability of other SADs necessitate a review of this area of practice.

JRCALC is mandated to recommend the most effective, evidence-based treatment for patients requiring emergency and urgent care. JRCALC has recommended that this area of clinical practice is examined in more detail to produce guidance and recommendations for future practice and requested that a group is formed to undertake this review.

This group has therefore been formed from experts in the field of pre-hospital airway management to examine current practice, review evidence of the effectiveness of pre-hospital paramedic tracheal intubation, discuss the adequacy of current training arrangements and report their findings and recommendations to the JRCALC Committee.

Although the initial remit was to review *paramedic* airway management, it was recognised that ambulance Trusts use the services of other professional groups such as nurses and doctors. It is also recognised that some doctors are able to deliver drug-assisted airway management on scene. Although this document discusses paramedic practice, the conclusions are applicable to other pre-hospital care professionals who are trained to similar or lesser standards as paramedics. The review specifically does not address issues relating to drug-assisted intubation which in the UK is currently undertaken only by doctors and is currently being reviewed by a working party from the Association of Anaesthetists of Great Britain and Ireland (AAGBI).

3. Intubation by paramedics: risk:benefit analysis

Intubation for cardiopulmonary resuscitation

Tracheal intubation has long been regarded as a fundamental and essential component of cardiopulmonary resuscitation (CPR). It has been assumed that tracheal intubation improves the chances of survival from cardiac arrest. There are no robust scientific data to support this belief and there are several reasons why attempted intubation can be harmful, particularly when undertaken by inexperienced individuals.⁷ The Ontario Pre-hospital Advanced Life Support (OPALS) study documented no improved survival to hospital discharge when the skills of intubation and cardiac drug administration were added to an optimised Basic Life Support-Automated External defibrillator (BLS-AED) system.⁸

The potential benefits of placing a cuffed tube in the trachea during CPR include:

1. Enabling effective ventilation, particularly when lung and/or chest compliance is poor.
2. Minimising gastric inflation and therefore the risk of regurgitation.
3. Protection against pulmonary aspiration of gastric contents.
4. Enabling ventilation while continuing chest compressions uninterrupted. This increases the number of compressions delivered in each minute.⁹

It is known that the oesophageal sphincter pressure decreases rapidly from 20 to 5 cmH₂O immediately after cardiac arrest and this predisposes to regurgitation of gastric contents.¹⁰ Regurgitation is documented in about one third of out-of-hospital cardiac arrests and in two thirds of these cases it occurs before arrival of ambulance personnel.¹¹ Pulmonary aspiration after cardiac arrest has been documented in 20% survivors¹² although the impact on outcome is unknown. The chances of successful intubation and the risk of complications are highly dependent on the skill of the individual undertaking the procedure. Several studies indicate that in inexperienced hands the success rate is as low as 50% and complication rates are unacceptably high.^{13 14} This is largely because tracheal intubation does not 'fail safe'. The risks of attempting tracheal intubation include:

1. Hypoxaemia, especially during prolonged attempts without oxygen supplements, and hypercarbia, when time perception by the rescuer is poor.
2. Harmful, physiological stress to the patient, in particular when performing laryngoscopy.
3. Unrecognised oesophageal intubation: 2.9 – 16.7% in cardiac arrest studies¹⁴⁻¹⁸
4. Unrecognised main stem bronchial intubation¹⁹
5. Unrecognised dislodgement
6. Interruption of chest compressions during the procedure
7. Trauma to the oro-pharyngeal tissues.

In the apnoeic patient, unrecognised oesophageal intubation is almost certainly fatal. In an emergency medical services (EMS) system with significant rates of unrecognised oesophageal intubation, correctly placed tracheal tubes would have to improve outcome for many other patients in order to offset these disasters. Such a benefit for tracheal intubation in cardiac arrest is very unlikely.⁸

The only prospective randomised trial of pre-hospital tracheal intubation versus management of the airway with a bag-valve-mask (BVM) has been undertaken in children.¹⁹ This showed no overall benefit for tracheal intubation and in a subgroup of children with primary respiratory arrest, the outcome was worse in the tracheal intubation group.

Intubation for trauma

Training in tracheal intubation and skill retention is increasingly problematic. Supraglottic airway devices are now used in up to 80% of anaesthetics in the United Kingdom and this reduces the number of opportunities for paramedics to intubate patients. One study of anaesthesia residents showed that a 90% in-hospital intubation success rate was achieved only after 57 intubation attempts;²⁰ furthermore, intubation is much easier under the conditions of elective anaesthesia than it is in the pre-hospital setting. Among

paramedics, intubation success rate has been shown to correlate with the intubation experience of individual paramedics and not with their length of service.²¹ Some studies have documented much higher intubation success rates by paramedics but these have generally been retrospective or via self-reporting.^{22,23} Use of end tidal CO₂ monitoring will reduce the incidence of unrecognised oesophageal intubation,²⁴ but during cardiac arrest, CO₂ may not be detected even if the tracheal tube is placed correctly.²⁵

Data to support paramedic intubation of trauma patients are also scarce. One retrospective study from San Diego concluded that pre-hospital intubation of patients with severe head injury improves survival.²⁶ However, given that these patients were intubated without drugs, the reported survival rate is remarkably high. Furthermore, there was no correction for case mix and there was no mention of how many attempted, but failed, intubations occurred – these would be included in the no intubation group. In contrast, there was just one survivor out of 492 pre-hospital trauma patients who were intubated without drugs by paramedic or doctors working with the London helicopter emergency medical service (HEMS).²⁷ The only other published research showing improved survival after paramedic intubation was a small Finnish study involving head-injured children.²⁸ More recently, a prospective study of rapid sequence induction in 243 severe brain-injured patients by the San Diego group reported that, compared with historical non-intubated matched controls, mortality was significantly higher (33.0% versus 24.2%) in those who were intubated.²⁹ Paramedics intubated after giving midazolam and suxamethonium, and after confirmation of correct tube placement gave rocuronium. Using this technique, intubation still failed in 13% of patients. One third of the study group turned out to have a minor concussion or no head injury. In another study involving a subgroup of 54 patients from the same cohort, 57% became hypoxaemic (SpO₂ < 90%) during the intubation attempt.³⁰ The same investigators have shown that hypoxaemia and hyperventilation (identified by end-tidal CO₂ monitoring) are associated with increased mortality.³¹ A recent review of pre-hospital tracheal intubation concluded that not only was there no evidence of benefit, but that there was increasing evidence of harm.⁵

Alternative airway devices continue to improve and some of the more recently introduced supraglottic airway devices may enable oxygenation and ventilation without the risks associated with tracheal intubation. In particular, insertion is independent of factors used

to predict or score difficult tracheal intubation.^{32 33} These issues apply to any professional group that is not experienced in tracheal intubation - not just paramedics.

4. Training requirements for tracheal intubation

How much training is necessary to become competent in tracheal intubation?

Current IHCD standards require trainee paramedics to achieve 25 intubations during hospital training, of which five must be unassisted. To the best of our knowledge, this figure was chosen because it was considered to be a reasonable number to provide paramedic training, rather than a number based on a scientific assessment of learning curves for intubation.

The attainment of 25 tracheal intubations cannot be taken as assurance of subsequent ability. The use of a logbook to record tracheal intubation has been challenged because it "...gives no clear idea of skill or of progress and merely records 'exposure' to a skill or technique."³⁴ Setting of a numerical standard also does not guarantee competence of any given skill and in a group of individuals, there will always be variation in the rate of skill acquisition with some individuals requiring more training than others.³⁵

Some recent studies have attempted to define the number of attempts needed to perform a given procedure in order to be competent. The learning curve for anaesthetic trainees learning tracheal intubation with two new tracheal tubes has been reported (Fig.1). The estimate of learning half-life (half the total number of procedures necessary to be performed in order to be competent at a given procedure) was 15 intubations, irrespective of the type of tube used³⁶. Similar results were reported in a study examining first-year anaesthetic residents where it was found that 57 attempts at tracheal intubation were required to achieve a 90% success rate (Figure 2).^{20 36} More recently, an abstract detailing training requirements for tracheal intubation, reported that 32 intubations were necessary for a 75% success rate and 53 for a 90% success rate.³⁷ These figures are similar to those reported in the two earlier studies.^{20 36}

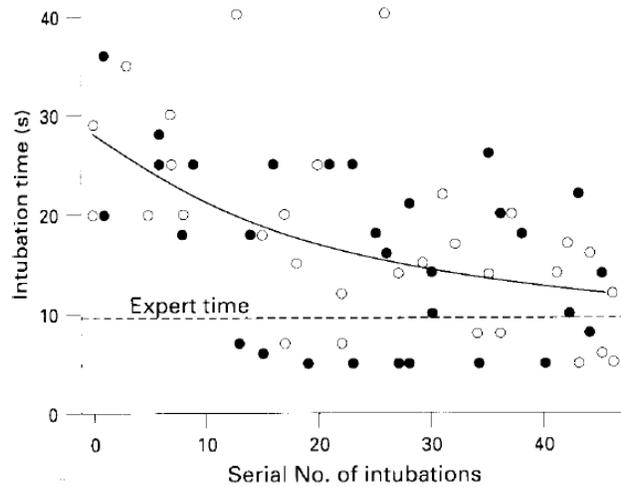


Fig 1: Intubation time vs serial number of the intubation for the 62 cases in which intubation was successful at the first attempt. ○ = Oxford tube, ● = Portex tube.³⁶

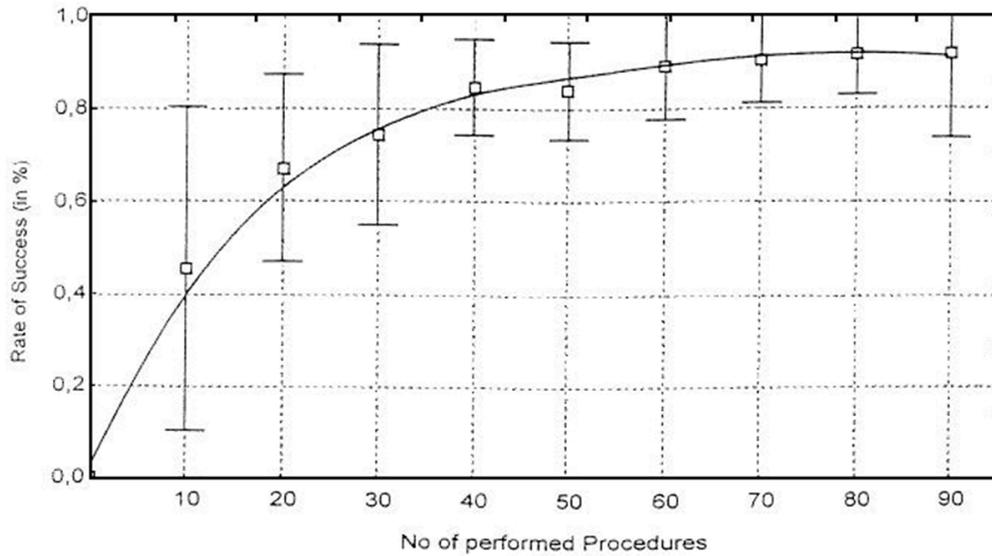


Fig 2: Rate of success for tracheal intubation vs number of performed procedures for first-year anaesthetic residents.²⁰

It is clear from these studies that for the majority of those training in tracheal intubation, the 25 attempts at tracheal intubation currently recommended is unlikely to be adequate

to attain competence. To reach a 90% success rate with the first intubation attempt, an average laryngoscopist needs at least 57 intubation attempts.²⁰ By applying the results of these three studies^{20 36 37} to current paramedic training, we estimate that under ideal intubation conditions, the average paramedic is likely to achieve an intubation success rate of 70 - 75% at best; with little scope for further improvement in skills performance in practice after initial training.

Skill fade

There are few studies on skill fade in relation to tracheal intubation. Skill fade is faster with more complex tasks. It is therefore likely that skill fade with tracheal intubation occurs at a greater rate than that with more simple airway skills, such as SAD insertion. Skill fade is accelerated by lack of ongoing practical experience. The average paramedic intubates an average of just 1-2 patients per annum.³⁴ There is a significant correlation between the number of patients intubated each year by a paramedic and intubation success rate ($p < .001$, $R = 0.32$).^{38 39} In medical students given practical instruction in tracheal intubation and re-assessed at 6 months, there was a significant decline in performance, as shown by an increase in failure rate, increase in attempts at intubation, increased time to achieve intubation and increased dental trauma.⁴⁰

With incomplete initial training and the subsequently limited opportunity to practice tracheal intubation skills, tracheal intubation performance is likely to be sub-optimal in paramedics trained within the current infrastructure and practice.

Opportunities for Training

Current paramedic training involves the intubation of 25 patients during the trainee's hospital attachment. It is widely recognised that this is becoming more of a challenge because airway management during general anaesthesia is moving away from tracheal intubation and therefore providing fewer opportunities. Medicolegal considerations and the recent statement from the AAGBI² about consent for paramedics to practice clinical airway management have also contributed to the decline in practical opportunities for tracheal intubation.

Some of the basic intubation skills and knowledge can be acquired using simulation with a manikin. Although simulators are improving all the time, they are not a complete substitute for the training required on real patients. Refresher courses including manikin training may help skill retention.

Supraglottic Airway Devices

The first successful and widely used supraglottic airway device (SAD) was invented in 1981 by Archie Brain, a consultant anaesthetist at the Royal London Hospital. His aim was to produce an airway for use in anaesthesia that was more practical than a face mask but less invasive than a tracheal tube, obtaining a continuous clear airway, closer to the natural anatomical and physiological pathway than via a tracheal tube, with the subsequent added benefit of providing a tracheal intubation aid.⁴¹ The first paper describing its use was published in 1983⁴² and the device became commercially available in 1988. Since its introduction, it is now estimated that there are more than 3000 publications relating to this device and it has been used on more than 200 million occasions worldwide. The device was originally designed as a reusable airway for use in anaesthetised patients breathing spontaneously and although this remains its main application, it has an important role in several other situations, for example resuscitation,⁴³ and is used increasingly by non-medical healthcare professionals.⁴⁴

Since 1988, the LMA has evolved into a number of different forms that are suitable for a variety of circumstances:

- A reinforced version to enable the tube to be flexed without the risk of kinking
- The intubating laryngeal mask (ILM) that once inserted acts as a conduit to enable the insertion of a tracheal tube without the need for direct laryngoscopy
- The ProSeal (PLMA), with an additional posterior cuff to improve the seal around the glottis and facilitate positive pressure ventilation; and an extra oesophageal drain tube which can guide correct positioning of the device.⁴⁵
- Disposable versions of the classic LMA, the PLMA (LMA Supreme) and the ILM to reduce the risk of cross infection.

Once the original patent expired, other manufacturers were quick to produce similar devices. Not all of these have been successful, but there are now several disposable (or single use) devices available, all with slight design variations compared with the original, the latter now referred to as the classic LMA (cLMA). Brain's device has also stimulated a wide range of interest in the production of alternative devices to provide a secure means of managing the airway without the need for laryngoscopy. All of these devices

are now grouped together as SADs, although some are designed to function if placed either above or below the glottis. The following devices are available:

- Glottic aperture seal (GO2)
- Pharyngeal airway xpress (PAX)
- Cobra Perilaryngeal Airway (CobraPLA)
- Laryngeal tube (LT, LT-D, LTS, and LTS-D)
- Airway management device (AMD)
- Elisha Airway Device
- Combitube®
- Easytube
- Streamlined Liner of the Pharynx Airway (SLIPA)
- I-gel

Despite their designation as SADs, these devices vary considerably in their design and function. Consequently, it is increasingly difficult to determine the advantages and disadvantages of the different designs. Furthermore the situation is made more difficult by published trials in which there is no consistency in approach. There are currently:

- Trials in anaesthetised patients
- Insertion by anaesthetists, nurses, medical students, paramedics and fire-fighters
- Trials in manikins
- Trials in different makes of manikins
- Trials of insertion in cadavers
- Use with spontaneous and controlled ventilation
- Trials comparing dissimilar devices
- Varying numbers in trials
- Anecdotal evidence of use of devices

All of this makes comparisons and recommendations about devices, or the circumstances in which different devices may be useful, almost impossible. It must also be remembered that none of these devices have anything like the accumulated experience of usage associated with the LMA.

A summary of the current predicament is expressed succinctly by Cook: “New developments in supraglottic airways may offer benefits over the current preferred devices. Considerable further research in this area is justified. This might include an examination of the appropriateness of training in tracheal intubation to those who rarely use it.”⁴⁴

5. Other issues with tracheal intubation

Several other issues need to be considered when discussing optimal pre-hospital airway management. This section also discusses the use of devices to aid intubation and to confirm tube placement.

Securing the airway

As highlighted in the previous statement of JRCALC,¹ the primary aim should not be the use of a particular airway device, but to ensure a secure and effective airway, oxygenation and ventilation for the patient.

Several paramedic studies have shown that airway devices not requiring direct visualisation of the vocal cords are more successful in securing the airway. A simulator-based study comparing paramedic insertion of a Combitube[®] and tracheal tube (TT) found the time to airway placement was less for the Combitube[®] than the TT (median difference 26.5s, $p=0.002$).⁴⁶ A clinical study comparing paramedic LMA insertion with tracheal intubation found LMA insertion to be more likely to succeed compared with tracheal intubation. Furthermore, LMA insertion was successful in 80% of failed intubations.⁴⁷

Other considerations when choosing an advanced airway management device are the limited number of practitioners present (typically 2-3) at an out-of-hospital cardiac arrest in the UK. In theory, the use of an appropriately secure airway device with an automatic ventilator should release one practitioner to undertake other duties. Airway devices can be difficult to secure reliably: the airway may be dislodged when the patient is moved causing loss of the seal with the larynx or, in the case of a tracheal tube, oesophageal intubation. Hence, meticulous supervision of the airway has to be safeguarded at all times.

Risk of supraglottic airway device cuff leak during chest compressions

The European Resuscitation Guidelines 2005 state that: *“Intubation attempts will require interruption of chest compressions, but once an advanced airway is in place chest*

*compression will not require interruption for ventilation.*⁴⁸ The lower sealing pressures of SADs compared with tracheal tubes may result in a leak when attempting ventilation without interrupting chest compressions and this may cause gastric inflation and regurgitation. The frequency and scale of this problem is unknown.

Oropharyngeal leak pressure varies between SADs. Mean +/- SD oropharyngeal leak pressure is significantly higher with the SoftSeal LMA (21+/-6 cmH₂O) compared with the cLMA (17+/-7 cmH₂O) and LMA Unique (16+/-6 cmH₂O).⁴⁹ The laryngeal tube (LT) may provide an even better seal than laryngeal mask devices; LT airway leak pressures of 26.3 +/- 7.3 cm H₂O compared with 19.2 +/- 8.6 cm H₂O (P < 0.001) for the LMA.⁵⁰ Eight studies (858 comparisons) report significantly higher seal pressures with PLMA than cLMA, with median PLMA and cLMA seal pressures approximately 30 cm H₂O and 20 cm H₂O respectively. In 20% of cases PLMA seal exceeds 40 cmH₂O. Since its introduction the PLMA has also successfully been used for ventilation of morbidly obese patients (BMI >40, or >35 kg.m⁻² in the presence of obesity-related comorbidity).⁵¹

Airway security

Although the risk of aspiration is considered to be higher with LMAs than TTs, there is no specific evidence to support this assumption. A review of hospital cases published in 2004 identified just 23 published cases.⁵² These were all cases from hospital settings: the relative risk of aspiration in the pre-hospital environment is unknown.

Although other advanced airway management devices may reduce the risk of aspiration, devices with oesophageal cuffs, such as the Combitube[®], are associated with a small but important incidence of oesophageal laceration or rupture.⁵³

The LMA may be dislodged more easily than a tracheal tube, but leak pressure for both the PLMA and the cLMA is increased by cervical flexion and rotation.⁵⁴

The LMA can also cause trauma on insertion, and the risk of this occurring depends on the type of LMA. A study of novice doctors, each undertaking five attempts with three different LMA types in anaesthetised patients reported that a sore throat was experienced by 14% of patients in LMA Unique group, versus 41% and 42% in the LMA Classic and

SoftSeal groups respectively. The SoftSeal LMA was most frequently associated with blood on the mask (32%) compared with the LMA Unique (9%) and LMA Classic (6%).⁵¹

Tracheal tube as a route for drug delivery

Tracheal intubation enables the direct introduction of suction catheters into the trachea and bronchial tree. This is unreliable with supraglottic airway devices. Tracheal intubation also enables resuscitation drugs to be injected directly into the trachea when intravenous access is impossible. Absorption of drugs is unreliable when given by this route and this intervention is unlikely to impact on the outcome of cardiac arrest.⁵⁵⁻⁵⁷

Use of intubation aids: the intubating bougie

The bougie is commonly available in hospital to assist with difficult intubation and its use increases intubation success rates when intubation is difficult.^{58 59} Despite being recommended to support pre-hospital intubation,⁶⁰ few ambulance services train and equip their paramedics with bougies.⁶¹ Intubation in the pre-hospital setting is particularly challenging and it is logical to recommend that a bougie is used routinely.

Availability of devices for confirming tracheal tube placement

Confirmation of correct tracheal tube placement by physical examination alone is unreliable: some studies document unrecognised oesophageal intubation rates of 10%⁶² - 25%.⁶³ Exhaled CO₂ or oesophageal detection devices can be used to identify correct tube position. Confirmation of tracheal tube placement using capnometry is a mandatory minimum monitoring standard in UK anaesthetic and emergency departments. However, this is less reliable if the cardiac output is low or absent such as during cardiac arrest.⁶⁴ The use of the oesophageal detector device (ODD) is an alternative technique but is less reliable and does not provide continuous monitoring as does capnometry.⁶⁵ A survey in 2004 showed that virtually no UK ambulance service used either device routinely.⁶¹

Hospital vs pre-hospital practice

Hospital minimum standards for the practice of intubation⁶⁶ are not currently requirements for the pre-hospital environment where risks are higher. The lack of capnometry increases the risk of unrecognised oesophageal intubation. The lack of availability and training in the use of simple intubation aids such as the intubating bougie increases the number of failed intubations.

The minimum monitoring standards required in hospital should be applied to pre-hospital intubation and simple intubation adjuncts must be used to increase the safety and success of pre-hospital procedures.

6. Discussion

The group's aim was to critically evaluate the need for tracheal intubation as a core skill in ambulance practice and to make recommendations about the optimal pre-hospital airway management by UK ambulance services. This was primarily in relation to paramedic practice, but encompassing all those who undertake pre-hospital tracheal intubation without the assistance of anaesthetic drugs. The evidence for the benefit, or not, of pre-hospital intubation without the use of anaesthetic drugs was reviewed and debated in detail, as were the associated topics relating to current training in this procedure and availability of alternative airway devices. A systematic review of pre-hospital airway management was not undertaken as part of this exercise because it was considered that the recent reviews and expertise within the group covered all the main publications in this area and the costs and delay associated with performing a systematic review would have been significant.

The Committee was in general agreement that there is little evidence that pre-hospital intubation without the use of anaesthetic drugs improves outcome in seriously ill or injured patients. Although some studies are of limited quality, the balance of evidence suggests that paramedic intubation may be associated with a worse outcome than basic airway management using the bag- mask device. The reasons for this are not entirely clear, but may be related to difficulties in securing the airway, resulting in significant hypoxaemia during the attempts at intubation.

Intubation is a complex motor skill that requires adequate initial training and sufficient ongoing experience to maintain competency. Current paramedic training was reviewed against the limited evidence for training requirements. Most studies have demonstrated that in order to be competent in the procedure, initial training requires the successful placement of 50-60 tracheal tubes, compared with the 25 that is currently required. There were also concerns expressed that most paramedics do not have sufficient ongoing intubation experience to remain competent in the procedure.

Simple intubation adjuncts (e.g. intubating bougie) are not used by most UK ambulance services and these have been shown to improve tracheal intubation success rates in hospital airway management. Their use in pre-hospital tracheal intubation is recommended. Additionally, pre-hospital capnometry should be mandatory for tracheal intubation in order to minimise the incidence of unrecognised oesophageal intubation. This would bring pre-hospital practice in line with minimum monitoring standards for hospital practice.

Alternatives to tracheal intubation were discussed. Supraglottic airway devices have many advantages over tracheal intubation, particularly in relation to training and maintenance of practical skills. They also do not risk unrecognised oesophageal intubation. Their use in the pre-hospital setting is limited, but growing, and LMAs are now a standard airway device in use by many UK ambulance services.

The Committee concluded that pre-hospital tracheal intubation, as currently practiced by paramedics, could not be endorsed. What evidence there is, suggests that this procedure is more likely to be harmful than beneficial.

The way forward was discussed. It was considered impractical to recommend that all paramedics were trained to an adequate intubation standard and maintain these standards after qualifying. Although these standards have yet to be defined, they are likely to be to a significantly higher standard than that currently practiced and would have parallels with the initial training of doctors entering anaesthesia as a speciality. Training would also necessitate the removal of paramedics from front-line practice for considerable periods, which may not be endorsed by ambulance trusts with significant performance pressures. We agree with the recent NCEPOD report that recommended that the pre-hospital response for trauma patients should include someone with the skill to secure the airway, (including the use of rapid sequence induction and tracheal intubation).⁶⁷ The way in which this is delivered would be the responsibility of each ambulance trust. If ambulance trusts were to permit tracheal intubation as a specialist skill for some providers, these individuals should receive enough training to become competent in the provision of drug-assisted intubation. Very significant improvements in initial and ongoing training and education would be required to develop this as an autonomous specialist skill. This may be best achieved through a physician-based system, although this would require a more long-term approach.

For the majority of paramedics, this Committee recommends that tracheal intubation should be withdrawn and greater emphasis placed on airway management using an appropriate supraglottic airway device (SAD). (The importance of training to a high degree of proficiency in basic airway management skills should not be overlooked during training). Several SADs are in clinical use. It is not the scope of this review to recommend specific SADs and ambulance trusts should discuss the options with their local Clinical Advisory Groups. More pre-hospital research is urgently needed to understand the factors influencing morbidity and mortality in relation to airway management and establish the optimal device(s) with which the airway should be secured.

Where ventilation proves impossible, particularly when there is a history of possible choking, and other manual techniques have failed, laryngoscopy may be used to attempt to remove any foreign body. This does not require training in laryngoscopy to the same level of competence as that necessary for tracheal intubation and can be incorporated with current clinical airway management training.

A small but significant number of patients with partially or completely obstructed airways cannot be managed without the use of drug-assisted techniques. Trauma patients and those with obstructed airways not manageable with basic airway adjuncts or a SAD may need to be treated by a practitioner competent in pre-hospital rapid sequence induction of anaesthesia and intubation, for which there is currently little provision in the UK. The recent NCEPOD review of trauma management⁶⁷ found that 13.7% of patients with major trauma arriving by ambulance did so with a partially or completely obstructed airway, suggesting that current paramedic training does not equip them with sufficient skills and tools to manage these patients adequately. In 28.6% cases, patients were not intubated when reviewers believed that it should have been attempted. The report concluded that "...if pre-hospital intubation is to be part of pre-hospital trauma management then it needs to be in the context of a physician-based pre-hospital care system." This may be one option that ambulance Trusts should consider in delivering appropriately trained providers to care for those with difficult airways, "...to ensure that they are seen at the right time, in the right place and by staff with the most appropriate skills."⁶⁸

The Committee concluded that paramedic tracheal intubation can no longer be recommended as a mandatory component of paramedic practice and should not be continued to be practiced in its current format. If pre-hospital tracheal intubation is to be undertaken, it requires considerably more education and training than that currently provided for paramedics or the use of physicians with appropriate training in advanced airway skills. SADs are suitable alternatives to tracheal intubation. SADs should be introduced into all ambulance services and ambulance trusts should ensure that both paramedics and technicians receive adequate initial and ongoing training in the use of these devices.

The timescale for the introduction of any changes in paramedic practice should be decided at a local level. Changes to training and practice in both tracheal intubation and SAD use will need to be reviewed by individual ambulance services to decide the most appropriate way forward.

7. References

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