Title page

Airway Management in UK Ambulance Services: Results of the National Ambulance Service Airway Management Audit

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Abstract

Aim

To establish the range of airway devices provided to ambulance staff employed by the UK NHS ambulance services, which level of practitioner is allowed to use which device or intervention, and what the main factors were in the purchasing decisions taken.

Methods

Medical directors from all 14 UK NHS ambulance services were invited to participate in an anonymous, web-based survey of emergency airway management equipment provided within their service and which grades of practitioner were authorised to use the equipment they provided. Additionally, they were asked for the main reasons for the purchase of the selected equipment.

Results

All 14 ambulance services completed the survey questionnaire. A range of clinical grades is now employed by UK ambulance services although there is inconsistency in both title and skill set. All services provide a range of airway equipment, but there is no common inventory across UK ambulance trusts. Nearly all staff were authorised to use some of the basic equipment, but wider variations appear with more complex or sophisticated techniques. In particular there appears to be significant gaps in advanced equipment and those authorised to use it in respect of children.

Conclusions

The range of airway equipment and those authorised by ambulance services to undertake airway management interventions appears to be evolving. It is of concern that there remains an apparent lack of standardisation of the range of airway equipment provided by UK NHS ambulance services

Keywords

Airway management; paramedic; ambulance

Introduction

Effective airway management is an essential component in the management of the critically ill or injured. Substandard airway management is a contributory factor in patient hypoxia, a recognised cause of preventable deaths from trauma (Sanddal et al., 2011; Anderson et al., 1988). It is likely that hypoxia is also implicated in preventable deaths from illness. In the United Kingdom (UK), airway management in the out-of-hospital emergency environment is normally the responsibility of ambulance service personnel. UK ambulance services employ a number of different practitioners, such as emergency medical technicians (EMT), paramedics, critical care practitioners (CCP) and doctors, although the range of practitioners is subject to variation across the UK. Each level of practitioner has a different skillset in relation to airway management and airway management would normally be the responsibility of the practitioner with the greatest clinical skill level available at any given time. By frequency, that role is generally adopted by the ambulance paramedic although there has been increased involvement by prehospital physicians with a more advanced airway skillset.

Not every ambulance response involves a paramedic or physician; many incidents are responded to by an EMT or other ambulance practitioner such as an Emergency Care Assistant (ECA). The airway management skillset has always tended to narrow towards the lower end of the hierarchy of prehospital practitioners; however initial patient interventions may be undertaken by practitioners of the EMT or ECA grade tasked as a solo responder on a rapid response vehicle (RRV) or as the lead clinician on a double-crew ambulance. There is no specific requirement for physicians to attend prehospital emergencies in the UK and their attendance is unusual except in the context of the air ambulance services. 40% of the UK air ambulance services always carry physicians as part of their response and 30% for some of their missions (Cowan et al., 2012).

A study published in 2004 (Ridgway et al., 2004) identified the airway devices available for paramedics at that time and established wide variations in the equipment available to paramedic crews in the United Kingdom. The practice of some ambulance services were identified as being sub-optimal and

several were failing to meet accepted standards of care for endotracheal intubation. The report recommended that there should be provision of a standard set of airway management equipment to all paramedic crews in the United Kingdom together with the introduction of appropriate training programmes. Since then there has been a reconfiguration of NHS ambulance services, significant changes in the profile and education of ambulance service clinicians, the development of new airway devices, and an increasing body of literature to inform airway management. The aim of this paper is to establish the range of airway devices provided to ambulance staff employed by the UK NHS ambulance services, identify which level of practitioner is allowed to use which device or intervention, and what the main factors were in the purchasing decisions taken. The results can be used to provide ambulance services and stakeholders with knowledge about how other services are responding to deal with the challenges of prehospital airway management.

Methods

An internet-based survey entitled the National Ambulance Service Airway Management Audit was created using the Bristol University Online Survey Tool (University of Bristol; www.survey.bris.ac.uk). The survey consisted of a total of 44 questions relating to the range of airway equipment provided, which grade of staff was able to undertake the associated intervention and the factors influencing purchasing decisions. A copy of the survey can be found in appendix A. The survey was produced from a number of pilot questionnaires within our department and tested prior to distribution. Medical directors of each NHS ambulance service were contacted via e-mail and were asked to participate in the anonymous survey. A link to the survey was attached in every e-mail. It was not expected that the medical director would necessarily complete the survey but that they would direct it to the most appropriate person in the organisation. Reminder emails were sent to the medical director of any service that did not respond within four weeks and if there was still no response, a request was made of the research paramedics employed by those organisations who all obtained permission from the medical director to complete the survey. One ambulance service completed the survey twice but

clearly indicated which response they wished to be included in the audit so the initial response was excluded from the study.

Results

Responses were initially received from 11 of the 14 ambulance services, and from the remaining three services following a reminder, thus giving a 100% response rate.

The grade of staff currently employed by ambulance services in the UK is presented in table 1.

All ambulance services are using oropharyngeal airways (OPA) and every service permitted all grades of staff to use the full range of OPA sizes that they carried. The only size of OPA that was universally available was size 3 although most services did carry a range from between 00 and 4. Provision of OPAs in size 5 and above was uncommon. Nasopharyngeal airways (NPA) were universally available in sizes 6 and 7 and were authorised for use by all grades of practitioner with the exception of one service. In that service ECAs were not authorised to use a nasopharyngeal airway because of the perceived risks related to nasal bleeding and insufficient understanding of the anatomy of the skull. Most services had no specific guidance or equipment for managing nasal haemorrhage caused by insertion of an NPA other than to advocate suction, postural drainage with further referral to national ambulance guidance on the management of epistaxis.

All paramedics were provided with and permitted to use a supraglottic airway device (SAD) in a range of sizes but access to and the authority to use SAD was inconsistent for other clinical grades. Only one service allowed their ECAs to use a supraglottic device whilst 11 of the 13 who employed EMTs allowed them to use SAD. One service stated that only EMTs who had a minimum of five years of experience and who had undergone additional training were permitted to use a supraglottic device. One of the 2 services that did not allow their EMTs to use supraglottic devices highlighted that a group of more advanced technicians were permitted their use although the training of the more

advanced technician was unclear. The range of available sizes of SAD and the type of SAD utilised by services can be found in table 2. The i-gel is the most commonly used SAD in UK ambulance services.

Tracheal intubation was not permitted for any clinical grade below the level of paramedic. All services allowed their paramedics to perform tracheal intubation although one service did not allow paramedics who trained post-2010 to perform the intervention. This service allowed paramedics who qualified prior to 2010 to continue to perform tracheal intubation as long as they complied with policy and remained current. Five out of 6 (83%) services who employed nurses allowed them to perform tracheal intubation but only 4 out of 14 (29%) services said that they allowed student paramedics to practice the skill. Table 3 identifies the availability of equipment for tracheal intubation. All services indicated that they were providing tracheal intubation aids and some offer their clinicians a choice of stylet and bougie. Most services have opted for a disposable bougie with coudé tip. All services indicated that they provided graphical waveform capnography for confirmation of tube placement; 3 also stated that they had non-graphical waveform capnography and 5 also used colorimetric capnometry.

Discussion

This survey found that although there has been significant development in rationalising the airway management equipment available in UK ambulance services over the last decade, there are still variations in the equipment and the clinical grades authorised to use this equipment or undertake a specific airway intervention. Where equipment is not available for use or where the initial emergency response is made by a clinician who is not authorised to use certain equipment or perform certain interventions, there is a risk that the ability to maintain a patent airway and therefore ensure adequate oxygenation could be compromised. The survey was made more difficult by trying to understand the varying titles that were used for each clinical grade with inconsistencies evident in the ECA, EMT and ECP titles. The advent of new roles and associated role titles have caused confusion as there is no nationally agreed scope of practice other than for initial registration as a paramedic. The

roles are often being defined locally by individual ambulance services in the absence of nationally agreed curricula, competencies and role definition. This is, to a lesser extent, true of initial registration for paramedics as there is significant variance in the academic level achieved by new registrants prior to application. Currently the threshold for entry to the paramedic register is set at "equivalent to certificate of higher education" (Health and Care Professions Council, 2014) but the qualifications achieved by new applicants range from in-house ambulance service vocational training through to BSc (Hons) programmes. Newer roles such as advanced technicians, critical care paramedics (CCP), advanced paramedics, paramedic practitioners, and emergency care practitioners (ECP) are emerging within the prehospital workforce but what remains unclear is what skill set these practitioners have, what airway interventions they are trained in and authorised to use, and in what circumstances.

Our survey found that all ambulance services now provide a range of NPAs with sizes 6 and 7 being universally available. The frequency of use of NPAs in UK ambulance services is not currently known but it is most likely indicated to provide a patent airway in a patient where the oral route cannot be used, for example, where trismus is involved or where the patient's level of consciousness means that an OPA would not be tolerated. The risk of bleeding into the airway following insertion of an NPA is considerable due to a combination of the relatively unprotected superficial location of the blood vessels, the high vascularity and the dual blood supply to the nose. One report suggests that bleeding may occur in up to 30% of patients (Stoneham, 1993) so there is clearly a need for guidance on how best to manage the complications. Such complications include aspiration of blood or clots, increased obstruction of the airway, and the delay of other essential interventions if the clinician is focused on managing the haemorrhage. Most ambulance services provide little guidance on how to manage nasal bleeding following NPA insertion and little equipment is provided to help them to control bleeding, especially in the posterior nares. Several services stated that they referred their clinicians to the national ambulance guidance on the management of epistaxis although no guidance is provided in

the Joint Royal Colleges Ambulance Liaison Committee guidelines (Association of Ambulance Chief Executives, 2013).

There has been a significant change in the availability of supraglottic devices since the publication of the last ambulance service airway audit in 2004 (Ridgway et al., 2004). At that time only 39% of ambulance services provided supraglottic devices whereas today they are universally available. The majority of services are now favouring the i-gel and cite the effectiveness and the quality of the device as being the most influential factors behind the purchasing decision. Of particular interest in this survey was the range of sizes available for practitioners. All services provided sizes 3 and 4 of one or more SAD, and all with a single exception also provided a size 5. The one service that did not provide a size 5 SAD was using the i-gel so the largest patient in which a SAD could feasibly be used would weigh less than 90 kg (Intersurgical Ltd., 2014). Given that there is a projected increase of 11 million in the number of obese people in the United Kingdom by 2030 (Wang et al., 2011) it is concerning that an ambulance service does not have a supraglottic device suitable for this growing population. The service did carry up to a size 9 tracheal tube so there is facility for advanced airway management in patients who are in excess of 90 kg but concern remains about the ability of paramedics to perform tracheal intubation in the emergency situation, especially in patients who are obese. Our study also identified concerns relating to the supply of smaller SADs. One service had neither a SAD nor a tracheal tube that was suitable for a patient below 20 kg, which means that clinicians working in this service would be dependent upon manual manoeuvres and OPA to secure the airway of a child below the age of about 6-years (Association of Ambulance Chief Officers, 2013). It is estimated that approximately 25% of medical admissions to the Emergency Department are for children between 0 and 15 years of age with the majority (69.8%) being younger than four years of age (Sands et al., 2012). Of this group, 20% present with breathing difficulty and 10.6% arrive by ambulance (ibid). Given these data it is difficult to justify the provision of a paramedic led emergency service that is unable to offer advanced airway support to those below the age of 6 years.

The move towards the i-gel is in keeping with the benefits of this device cited in the literature. Recent studies have shown insertion success rates of 90-94% for the i-gel in patients experiencing out-of-hospital cardiac arrest, which is better than intubation success rates and also higher than the first generation laryngeal mask airways (Duckett et al., 2013; Häske et al., 2013; Middleton et al., 2014). Anecdotal evidence has suggested that the i-gel may be less suited to prehospital use due to exposure to cold temperatures that may affect the seal. This has been attributed to the thermoplastic properties of the device and although no significant studies have substantiated this concern, it has previously been postulated that seal pressures improve over time as the device warms to body temperatures (Gabbott and Beringer, 2007). This is perhaps an area for further study given the fluctuations in temperature on ambulances and in the out-of-hospital environment.

Tracheal intubation remains contentious in prehospital care but there have been major improvements in the equipment provided for difficult intubation and for confirmation of tube placement. In 2004, only 37% of UK ambulance services had any aid for tracheal intubation whereas today all services provide a bougie and 5 (36%) offer a stylet in addition to the bougie. It is unclear whether paramedics have been trained in the use of these devices and whether they are used routinely for all intubation attempts or only when a difficult intubation is encountered. Tracheal intubation by paramedics is usually performed in sub-optimal conditions in an emergency situation and often by practitioners who are inexperienced in the skill (Deakin et al., 2009) so it is reasonable to argue that every intubation should be treated as a difficult intubation and a bougie used routinely.

Equipment for confirming placement of the tube has also improved since 2004 when 76% of services had no equipment beyond a stethoscope to confirm placement. Today, all services state that they are using graphical waveform capnography although qualitative data from our study suggests that it is not available to every paramedic at all times.

A significant finding of our study was that three services provide tracheal tubes suitable for young children but do not provide SADs for that group of patients. This means that tracheal intubation is the

only advanced airway of choice which is concerning if the findings of Deakin et al.[2009] are correct. They found that the majority of paramedics will have attempted tracheal intubation on one or less occasion in the previous twelve months. On occasions where an advanced airway is required for a young child it is unlikely that a paramedic with very limited experience of tracheal intubation will be the optimal practitioner to perform that task. Where there is no alternative in the form of a SAD, the paramedic is left with few viable options in cases where prolonged ventilation and airway management may be required. It is recommended that all ambulance services provide SADs for use on young children and ensure that paramedics are supported through training to compensate for the lack of clinical exposure.

Needle cricothyroidotomy was advocated for use by paramedics in the "can't intubate, can't ventilate" scenario whilst there has also been a move to allow some critical care paramedics to use surgical cricothyroidotomy techniques. It is unclear which technique is the best or indeed if either technique should be used by paramedics who will be unfamiliar with the procedures required at a time of acute emergency. The counter-argument is that there may be some merit in these techniques as a last resort when the patient is likely to die of airway occlusion that cannot be managed by any other means. A recent meta-analysis of prehospital airway management literature suggests that needle cricothyroidotomy is inferior to surgical cricothyroidotomy in terms of success rates (Hubble et al., 2010) but the quality of the reviewed literature was low. Additionally, patient outcome using either technique tends to be poor (Peterson et al., 2005; Cook et al., 2011) and the current European Resuscitation Council Guidelines make it clear that needle cricothyroidotomy can only be considered to be a temporary measure (Nolan et al., 2010). The literature does not allow a recommendation that all forms of cricothyroidotomy be removed from the skill-set of the paramedic but further studies should be undertaken to establish skill retention following initial training.

Conclusions

The range of airway equipment and those authorised by ambulance services to undertake those interventions appears to be evolving. It is of concern that there appears to be no standardisation of the range of airway equipment provided by UK NHS ambulance services. There is also inconsistency in which level of practitioner ambulance services authorise to undertake given procedures. This inconsistency undoubtedly results in different standards of airway care within and across ambulance service areas. Work needs to be undertaken to ensure that a coherent, evidence-based airway management policy exists across the whole of the UK ambulance services in order that patients can receive optimal airway management wherever they are in the Country.

Conflict of interest statement

The authors have no conflicts of interest to disclose.

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Legends for Tables and Figures

Table 1 Grades of staff employed by services (n=14). Number of services employing grade and percentage of all services employing staff of the given grade

Table 2 Availability of a Supraglottic Airway Device

T**able 3** Availability of equipment for tracheal intubation