Advanced airway management in the emergency department: what are the training and skills maintenance needs for UK emergency physicians?

C A Graham

This article reviews the evidence for the training of emergency physicians in advanced airway management.

The subject of advanced airway management currently generates much controversy and debate in UK emergency medicine specialist practice. Effective airway management is the central part of emergency resuscitation and many see it as an undisputable core skill for emergency physicians. Much of the current discussions centre around the specific technique of rapid sequence intubation (RSI), which is generally accepted to be the technique of choice for most situations in the emergency department. Several recent studies have demonstrated the emergence of emergency physician performed RSI in the UK with acceptable safety and complication rates.

Most published work from the USA and the UK concerning advanced airway management has tended to concentrate on the clinical performance of RSI and its associated complications. There has been comparatively little work looking at the training requirements for emergency physicians who wish to undertake this work in the UK.

For the past 25 years, higher specialist trainees in accident and emergency medicine in the UK have been required to undertake a minimum three month secondment in anaesthesia and intensive care. In the early days of specific specialist training in accident and emergency medicine, this was to orientate trainees who were predominantly from medical and surgical backgrounds to the concepts of anaesthesia and specifically to train them in basic and advanced airway management skills, namely endotracheal intubation.

At that time it was not generally expected that emergency medicine trainees would become competent in the use of anaesthetic or paralysing drugs within those three months and it was not envisaged that they would perform airway manoeuvres requiring anaesthetic or paralysing drugs without involving an anaesthetist.

During the 1980s the situation began to change. Several emergency medicine centres throughout the UK, notably Edinburgh, began to promote RSI in the emergency department and indeed in the prehospital environment. Minimum training requirements remained at three months of full time anaesthesia and intensive care, although many trainees were undertaking longer periods of training in anaesthesia. This was supplemented by regular “real life” use of the techniques in the emergency department, usually under senior supervision.

In the UK, a joint working party has been established between the Faculty of Accident and Emergency Medicine and the Royal College of Anaesthetists to produce a plan for the future training of emergency medicine specialists. Debate continues as to the precise training requirements and ongoing skills maintenance needs for emergency physicians who wish to provide a comprehensive advanced emergency airway service. Debate also continues over the training requirements for anaesthetists in the UK with respect to airway management.

AIM

This review aims to review the evidence for initial training for advanced airway management, and specifically, RSI, for emergency physicians as relevant to UK practice. It will also consider the evidence and requirements for skills maintenance in this field for the established emergency medicine specialist.

METHOD

Medline (1966–2002) and Embase (1980–2002) were searched using the following strategy:

```
(exp laryngoscopy OR laryngoscopy.mp OR exp intubation, intratracheal OR intubation.mp OR intubat$.mp OR induction.mp OR “rapid sequence induction”.mp OR “rapid sequence intubation”.mp OR “difficult airway”.mp OR “difficult intubation”.mp) AND (exp education OR education.mp OR training.mp OR exp internship OR residen$.mp) LIMIT to human AND English.
```

Manual searches of the bibliographies of relevant papers identified as a result of these searches were done and any further relevant papers were retrieved. The abstract books from the 2001 and 2002 annual scientific meetings of the Faculty of Accident and Emergency Medicine were also scrutinised.

The Web of Science database (previously the Science Citation Index) was searched using papers produced by Walls to identify further papers. The web sites of the Faculty of Accident and Emergency Medicine (http://www.faem.org.uk), the British Association of Accident and Emergency Medicine (http://www.baem.org.uk), the Royal College of Anaesthetists (http://www.bja...
www.rcoa.ac.uk), the Society for Academic Emergency Medicine (http://www.saem.org), the American College of Emergency Physicians (http://www.acem.org), and the Australasian College of Emergency Medicine (http://www.acem.org.au) were searched to identify any references to training requirements for airway management and the evidence for these. A manual search of Emergency Medicine, the journal of the Australasian College of Emergency Medicine, was done for 2000 to 2002 inclusive.

Data on the frequency of RSI in UK emergency departments were obtained from the Scottish Trauma Audit Group RSI Study Group and from the Trauma Audit and Research Network (TARN) for England and Wales. Data on previous work on developing a consensus curriculum for anaesthesia for trainees in emergency medicine was also obtained (personal communication, Dr Mark Nicol).

Finally, the curriculum for higher specialist training in accident and emergency medicine and the accompanying document on secondments were reviewed to identify current official UK requirements for training for emergency medicine specialists.

RESULTS

A total of 1487 papers were identified by the initial Medline and Embase searches, of which 405 were relevant to this review. The Web of Science search yielded a further 35 papers.

Review of the web sites listed previously revealed a policy statement on RSI produced by the American College of Emergency Physicians. The Royal College of Anaesthetists' web site provided information on basic anaesthetic training requirements in the UK. A further paper was identified in Emergency Medicine.

Table 1 summarises the relevant papers. Internationally agreed evidence levels (as defined by the Scottish Intercollegiate Guidelines Network) were assigned to each paper.

Data from TARN indicates the relative rarity of RSI in the emergency department in England and Wales. This retrospective study looked at a subset of the TARN database for the past 10 years with good data capture for intubation data. It suggests that in an average department size of 68,000 patients per annum, two emergency RSIs for trauma would be required per month. Data from STAG suggest a 2:1 ratio of non-trauma RSIs to trauma RSIs, so this would suggest a total of approximately six RSIs per month in the emergency department for a “standard” hospital.

Data from the STAG RSI Project Group also suggest the lack of “real life” experience with RSI for all practitioners in the emergency department. A total of 735 RSIs were performed over two calendar years in seven Scottish emergency departments staffed by a total of 24 consultants in emergency medicine. This equates to a mean of 31 RSIs per consultant per year or 2.5 RSIs per month. These figures are broadly comparable to the TARN data as described above.

DISCUSSION

The Faculty of Accident and Emergency Medicine documents on higher specialist training include the following references to training in emergency airway management, anaesthesia, and intensive care (see box 1). It can be inferred that there are no prescriptive guidelines on the type or number of specific procedures required for airway training in the UK for higher specialist trainees in accident and emergency medicine at present. An Australasian study suggests this is also the case in Australia and New Zealand.

Training requirements in airway management can be broken down into airway assessment, technical aspects of endotracheal intubation and alternative airway techniques, and rapid sequence intubation in itself.

Assessment of the airway constitutes one of the most important aspects of airway management. It is unclear from this review of the literature as to what constitutes an acceptable minimum training in airway assessment. Reports of management of the difficult airway consistently refer to the difficulties of its prediction despite using multiple accepted methods of assessment. It is obviously important to recognise signs of a potentially difficult intubation early in resuscitation, but the emergency physician must remain aware that unexpected difficult intubation will occur occasionally.

However, there is no specific requirement in the curriculum for emergency medicine in the UK for trainees to develop skills in any of these techniques. If a difficult airway is anticipated in advance, senior anaesthetic and intensive care assistance can be sought without further delay while preparations are made to gather appropriate equipment and personnel to deal with that difficult airway safely. It would

![Table 1](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAA4AAAAAgCAYAAABzenr4AAAAGXRFWHRTb2Z0d2FyZQBBZG9iZSBJbWFnZVJlYWR5ccllPAAAAySFhSCsAAAiwAAAABh0bWiolAAAAAElFTkSuQmCC)

**Table 1** Summary of evidence

<table>
<thead>
<tr>
<th>Author</th>
<th>Reference</th>
<th>Topic</th>
<th>Principal results</th>
<th>Numbers</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>16</td>
<td>FAEM requirements for airway training</td>
<td>Consensus opinion</td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>Amarasinghe</td>
<td>20</td>
<td>Australia and New Zealand survey of anaesthesiology training requirements</td>
<td>Anaesthesiology training should focus on airway skills and last six months</td>
<td>315 emergency physicians</td>
<td>3</td>
</tr>
<tr>
<td>Koppel</td>
<td>29</td>
<td>Anaesthesiology training for difficult airway skills in US</td>
<td>Survey—only 27% of training programmes required a “difficult airway rotation”</td>
<td>143 programmes</td>
<td>3</td>
</tr>
<tr>
<td>Konrad</td>
<td>33</td>
<td>Learning curve for new anaesthesiologists</td>
<td>90% success rate after 57 attempts; 18% still need help after 80 intubations</td>
<td>11 residents</td>
<td>3</td>
</tr>
<tr>
<td>Chauluxananan</td>
<td>34</td>
<td>Minimum number of oral intubations for competency</td>
<td>9 residents, 100 intubations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Hayden</td>
<td>35</td>
<td>Number of intubations during three year emergency medicine residency in US</td>
<td>Mean 75 intubations over three years (95% confidence intervals 62 to 87)</td>
<td>65 programmes</td>
<td>3</td>
</tr>
<tr>
<td>Forrest</td>
<td>41</td>
<td>Simulators to test novice anaesthesiologists</td>
<td>Simulation can observe and quantify technical skills of anaesthesia</td>
<td>26 consultants, 6 novices</td>
<td>3</td>
</tr>
<tr>
<td>Chopra</td>
<td>51</td>
<td>Simulator training for anaesthesiologists</td>
<td>Training on simulator improves anaesthesiists emergency management</td>
<td>28 anaesthetists and trainees</td>
<td>1</td>
</tr>
</tbody>
</table>
Box 1 Curriculum for higher specialist training in emergency medicine

Knowledge base

- III Anaesthesia
  - (A) Principles of airway management
  - (B) Rapid sequence induction
  - (C) Pain relief
  - (D) General, regional, local anaesthesia
  - (E) Interface with intensive care

Clinical skills

- III Major trauma management
- IV Airway (cervical spine control)
  - (A) Basic airway management
  - (B) Advanced airway management (tracheal intubation/alternatives)
  - (C) Surgical airway

- V Breathing
  - (B) Ventilation techniques

be possible to define an expert consensus on what assessment skills should be expected of emergency medicine specialists.

The technical aspects of endotracheal intubation also need to be taught and learned, although it is difficult to define what competent means in terms of learning objectives. Konrad found that there was a rapid improvement in the success rates for endotracheal intubation during the first 20 attempts in novice intubators (anaesthesiology residents). A 90% success rate was reached on the learning curve after a mean of 57 attempts at endotracheal intubation. However, after 80 intubations, 18% of residents still required assistance. Although it is difficult to be clear on exact numbers and accepting that there will always be variations between people, it would seem that novice anaesthesiology residents require 80 or more intubations to achieve reasonably consistent skills in endotracheal intubation.

In another small study on anaesthetic trainees in Thailand, the minimum requirements for competency in oral tracheal intubation was determined to be 27 cases. The small numbers in this study again cast doubt on whether this is accurate. It remains to be seen whether emergency medicine will be required to develop competency based objectives for airway management. In the UK, several studies have reported on the requirements and experience of their residents in emergency medicine. Hayden and Panacek reported that the mean number of intubations per trainee was 75 (95% confidence intervals 62 to 87); this is over a three year residency in emergency medicine in a US setting. This remains concerning as it is below the 80 intubations required in Konrad’s study to achieve an acceptable level of procedural competency for endotracheal intubation. Indeed, 80 may be too low a number as it included all intubations, not just the intubations performed in the difficult emergency department environment. The use of novel teaching tools such as laryngoscopic video imaging may improve teaching in this difficult skill. Human simulators have been shown to be effective in training novice anaesthesiologists technical skills and it is probable that this would be a useful tool for emergency medicine trainees as well.

There is no consensus among UK anaesthetists as to how many intubations are required for anaesthetic trainees. Important concerns about training in airway management for anaesthetists have been raised recently. Some anaesthetists have suggested at least 20 intubations a week per SHO, which would suggest a total of 1040 intubations per annum. In the era of the laryngeal mask, it is highly unlikely that any anaesthetic trainee will gain this level of experience.

Others have suggested that the laryngeal mask airway should only be used in 25% of cases, using basic airway management and endotracheal intubation for others in the interests of training. Similarly this is unlikely to gain popularity given the significant clinical advantages of the laryngeal mask airway in elective anaesthesia. It is therefore very difficult to extrapolate these opinions to the field of emergency medicine.

It is widely accepted that endotracheal intubation in the emergency room is significantly more hazardous and associated with an increased rate of difficult intubation and failed intubation than that in the operating room. Koppel and Reed surveyed anaesthesiology residency programme directors as to what formal instruction is provided to their residents in difficult airway management. Only 27% of the responding programmes required residents to participate in a rotation dedicated to the management of the difficult airway. UK training of this nature seems to be rare and difficult to obtain, even for anaesthetists.

The only two techniques that were commonly taught on patients were the flexible fibreoptic laryngoscope and the laryngeal mask airway. Bearing in mind that this is an American study, at that time the use of the laryngeal mask airway was somewhat less that in the UK. However, it is probable that in the UK the laryngeal mask airway would be the immediate rescue airway for most anaesthetic and emergency medicine personnel in the event of a failed intubation given its popularity and familiarity with use.

Anaesthetic simulators have also been used to improve the training of junior and senior anaesthetists in the UK and other parts of the world. These expensive, dedicated machines are limited in number in the UK but can provide extremely valuable experience especially for rare emergencies that typify anaesthesia (for example, malignant hyperthermia, anaphylaxis, etc). These rare crises can be modified for the teaching of emergency medicine specialists. Such crises may include management of the burned upper airway, management of the patient with profound hypovolaemia, and management of the unexpectedly difficult intubation. The principal value of the simulator is teaching the decision making process (“non-technical skills”) leading to the critical intervention, rather than perfectly replicating the technical skills required for that particular scenario.

In Scotland, a joint emergency medicine and anaesthesia collaboration has lead to the development of the Scottish Airway and Ventilation Emergency Course (the SAVE course) based at the Scottish Anaesthesia Simulator Centre at Stirling Royal Infirmary. A one day course format consists of familiarisation with the simulator and exposure to one scenario per participant as the team leader, which is video taped and peer reviewed by colleagues and teaching faculty. This course now also occurs in Bristol and London.

General feedback from early participants in this course has been extremely favourable with many participants expressing a desire to have more training of this nature. Its major advantage is that there is no risk to human patients, and all the variables can be independently controlled for a given simulation. Therefore not only anatomical airway difficulties can be introduced, but physiological effects of different drug
doses and regimens can be introduced to ensure a realistic scenario for the participant.

It has been shown that training on anaesthesia simulators has improved the performance of anaesthetists in dealing with emergencies during anaesthesia.\(^{51,54}\) It is probable that this would also be seen in emergency physicians.\(^{55,64-68}\)

Specific theoretical learning objectives, such as airway assessment techniques, may be mastered by a combination of didactic lectures and personal study.\(^{69}\) The American National Emergency Airway Course may also be a useful educational device to introduce emergency physicians to the management of the emergency airway.\(^{69,70}\) Practical technical education (for example, endotracheal intubation) could be carried out in a clinical skills laboratory setting and subsequently in a human anaesthetic simulator.\(^{71}\) In addition, it would be appropriate to demand that emergency physicians pass the Royal College of Anaesthetists’ initial test of competency as part of their initial anaesthesia training.\(^{72}\)

It has recently been suggested that future training of UK emergency medicine specialists should include a one year anaesthesia and critical care rotation, involving six months of full time anaesthesia followed by six months of full time critical care.\(^{73}\) While this in itself would be most useful, it will be important to have specific learning objectives in mind.\(^{74}\) Emergency physicians have different learning requirements and different competency requirements from trainees in anaesthesia and consequently their training must be tailored to accommodate this.\(^{75}\) Training requirements and specific competencies will have to be defined to ensure a minimum standard of training and competence in all aspects of emergency airway management across the specialty. It will also be important in the future to carefully study the effects of increased length and quality of training for emergency physicians on the success and failure rates for airway management in the emergency department as performed by these physicians.

It is also important that emergency medicine trainees develop competency in the immediate ongoing (post-intubation) management of the critically ill patient.\(^{76,77}\) There is little point in successfully securing the airway if there is no capability to provide appropriate ongoing ventilatory and cardiovascular support. These skills should include the safe use of anaesthetic and sedation agents for adults and children; safe use of neuromuscular blocking agents; appropriate ventilatory strategies for specific situations, for example acute severe asthma, severe head injury; rational use of inotropes and fluid management; expertise with invasive monitoring, including the ability to place arterial and central venous catheters. The proposed period of six months critical care training for emergency medicine trainees should be regarded as a minimum.

**CHILDREN**

There are very few data relating to the management of the paediatric airway in the emergency department. A recent American study suggests that emergency physicians can manage the paediatric airway safely and recommends the use of RSI in this age group.\(^{78,79}\) Other observational series support this view, all from the US.\(^{80,81}\) Recently published data from STAG suggest that the frequency of paediatric intubations in general Scottish emergency departments is a low as three intubations per department per annum, which means that advanced airway skills will be required very rarely, regardless of the grade or specialty of the intubating staff.\(^{82,83}\)

The current UK recommendations for anaesthetists accept that there are many anaesthetists who do not have a regular paediatric practice, but that they may still have to provide an acute resuscitation service for critically ill children.\(^{84,85}\) They recommend that consultant anaesthetists should be able to undertake regular supernumerary paediatric lists or secondments to specialist paediatric centres to maintain skills. Consultants and trainees in emergency medicine should also consider obtaining this type of training to maintain skills. It is vitally important to try to maintain airway skills for this age group, but increasingly difficult to do so. In future, paediatric high fidelity simulators may provide a partial solution to this problem.

**MAINTENANCE OF SKILLS**

Maintenance of skills in emergency airway management is also a subject of considerable debate presently.\(^{86}\) There is no objective scientific data to support a minimum requirement of numbers of emergency intubations or RSIs to be performed by emergency physicians (or indeed anaesthetists) to maintain competency in this area. It is probable that without regular exposure and experience in any particular technique, skills in that technique will deteriorate over time. What steps therefore should be taken to ensure continuing competence in this complex matrix of assessment and therapeutic skills?

It is highly unlikely that any individual emergency physician or anaesthetist in the UK will see enough cases that require rapid sequence intubation in the emergency department regularly to maintain skills on that basis alone. The figures from the Trauma Audit Research Network suggest a maximum of about six RSIs per month per department (based on an average of 68 000 patients per year), which, if staffed by four consultants in emergency medicine, will equate to 1–2 RSIs per consultant per month. The STAG data also suggest that the individual consultant in emergency medicine would be likely to be involved in two to three RSIs per month. Accepting that, at current UK staffing levels, consultants cannot be in the emergency department every time an emergency RSI is required, this will mean that individual skills will be difficult to maintain on the basis of experience alone. If this small number of patients is diluted by consultant and trainee anaesthetists as well, then the prospects for individual skills maintenance using this method alone are very limited.

Other methods of maintaining skills in this area have to be sought therefore.

This may include the regular use of a high fidelity human anaesthetic simulator, in the manner described above, as this will ensure regular exposure to difficult scenarios more frequently than will happen in day to day practice. It could also entail regular experience in hospital anaesthetic rooms, although with the changing practice of anaesthesia in the UK (that is, many operations are now performed under general anaesthesia using the laryngeal mask airway rather than performing endotracheal intubation), exposures of this nature may not be as relevant to the practising emergency physician as they were previously. Surgical lists with exposure to large numbers of cases or difficult airways (for example, maxillofacial or otolaryngology lists) may provide useful intubation experience.

However, continuing practice in the management of the airway and the opportunity to use other airway adjuncts such as the laryngeal mask airway should be seen as a benefit, rather than of little use, given the laryngeal mask airway’s role as a rescue device in the event of a failed intubation. It also allows physicians to continue to use anaesthetic drugs in vivo under controlled conditions and with experienced support. It is unclear how much of these types of experience and continuing education would constitute a minimum for the emergency physician. It remains to be seen whether emergency physicians will have to prove competency and continuing maintenance of these skills by means of an externally validated assessment of skills\(^{87}\) and if so, how that will be done.
A national audit programme for emergency physicians’ airway skills is currently under development. It has also been suggested that individual emergency physicians should keep personal logbooks to show continuing safe activity in this field. Ongoing departmental audit may play a part as well, in ensuring that essential skills are maintained by all members of the team who are willing to provide the service.

CONCLUSION

There are no objectively defined training requirements for emergency airway management for the UK emergency physician at present. The current debate provides an opportunity for the development of specific learning objectives for airway management, with clear training objectives for higher specialist trainees in emergency medicine (box 2). The following suggestions are based on current practice but take into account the comments made in the literature reviewed. They also take account of Nicol’s previous work on the consensus curriculum for anaesthesia for emergency medicine trainees (personal communication). No attempt has been made to define minimum numbers of procedures, as the available literature cannot support such a suggestion.

Box 3 Skills maintenance programme for consultants in emergency medicine

1. Personal log of all intubations/airway interventions
2. Regular human simulator sessions
3. Regular sessions in local hospital anaesthetic room
4. Ongoing departmental audit of critical airway interventions
5. Combined anaesthesia/intensive care/emergency medicine reviews of cases

Maintenance of these skills will not be easy for the practising consultant in emergency medicine but one possibility is suggested in box 3. Again, these are distilled from the current published literature but questions about optimum or minimum numbers of procedures or sessions remain and require further research.

It remains paramount that each centre has a well defined and unambiguous system for dealing with acute airway emergencies, whether it is undertaken by emergency physicians, anaesthetists, or a collaborative approach. Even in hospitals where emergency airway care remains in the hands of anaesthetists, training requirements for emergency physicians must ensure that they still maintain a very high level of decision making skills with respect to critical airway situations.

ACKNOWLEDGEMENTS

I thank Ms Diana Beard, director of the Scottish Trauma Audit Group, for data on the frequency of RSI in Scottish urban emergency departments. I also thank Dr Tim Parke, consultant in accident and emergency medicine at the Southern General Hospital in Glasgow for information regarding the SAVE Course. I thank Dr Mark Nicol for data supplied about the consensus curriculum in anaesthesia for emergency medicine trainees that he developed. Thanks also to Mr Malcolm Gordon, Dr Tim Parke, Dr Phil Munro, and Mr Neil Nichol for commenting on the manuscript.

At the time of writing, I was supported by a Clinical Research Fellowship jointly funded by the Scottish Council for Postgraduate Medical and Dental Education (now NHS Education for Scotland) and the Chief Scientist Office of the Scottish Executive and I was in receipt of funding from the Medic 1 Trust Fund, Edinburgh. My thanks go to all those organisations for assistance with funding. All opinions expressed remain my own and do not necessarily reflect the views of any person or organisation named above.

REFERENCES

Advanced airway management

39 Smith HL. Training in difficult airway management. Anaesthesia 2001;56:381.
Advanced airway management in the emergency department: what are the training and skills maintenance needs for UK emergency physicians?

C A Graham

doi: 10.1136/emj.2003.003368

Updated information and services can be found at:
http://emj.bmj.com/content/21/1/14

These include:

References

This article cites 60 articles, 17 of which you can access for free at:
http://emj.bmj.com/content/21/1/14#BIBL

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/