

The difficult airway in the emergency department

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Abstract

Background The patient with difficult airways is a common challenge for emergency physicians.

Aims Our goal was to study the reasons for difficult airways in the emergency department.

Methods We performed a prospective observational study of patients requiring advanced airway management from 1 January 2000 to 31 December 2006.

Results There were 2,343 patients who received advanced airway management of which 93 (4.0%) were deemed difficult. The main diagnoses were cardiac arrest (28), trauma (27) and congestive heart failure (10). The main reasons for the difficult airways were attributed to an anterior larynx (38, 40.9%), neck immobility (22, 23.7%) as well as the presence of secretions and blood (14, 15.1%). The mean number of attempts at intubation was 3.6 versus 1.2 for all cases. The mortality rate of 40.5% among patients with difficult airways was not different from that of all patients who had airway management (41%). There were seven (0.3%) failed airways. Anaesthetists performed 21 (22.6%) of the rescue airways while surgeons performed 5 (5.4%). Of the rescue strategies performed, 24 were through the use of the bougie, 3 by cricothyroidotomy, 4 by tracheostomy, 6 with the GlideScope and 3 with the laryngeal mask airway. The rest the airways were secured by tracheal intubation using the laryngoscope.

Conclusions Emergency physicians manage most of the difficult airways successfully (68.8%). However, the success rate can be further improved through the more frequent use of the bougie or other rescue device. A possible suggestion would be for the emergency physician to use the bougie after the second or third attempt at direct orotracheal intubation.

Keywords Airway · Intubation · Laryngoscopy · Cricothyroidotomy · Tracheostomy

Introduction

The difficult airway is a challenge to emergency physicians. In the anaesthesia literature, its frequency ranges from 0.4 to 8.5% [1–3] of elective intubations. In the emergency medicine literature, it is more common—from 2 to 14.8% [4–9]—but it includes prehospital intubation and may be performed by paramedics or doctors.

The definition of the difficult airway varies in different literature sources. The American Society of Anesthesiologists Task Force on Management of the Difficult Airway defines it as the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation or both [10]. Suggested descriptions of the difficult airway include but are not limited to difficult face mask ventilation, difficult laryngoscopy, difficult tracheal intubation and failed intubation. The emergency medicine literature generally considers the difficult airway in three dimensions: difficult mask ventilation, difficult intubation and difficult cricothyroidotomy, by experienced personnel [11]. There is no consistent or single definition of the difficult and the failed airway.

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Table 1 Primary diagnoses

| Diagnoses | Difficult cases | Total | % Total |
|------------------------|-----------------|-------|---------|
| Seizure | 4 | 24 | 16.7 |
| Burns | 5 | 34 | 14.7 |
| Pneumonia | 8 | 65 | 12.3 |
| Trauma | 22 | 310 | 7.1 |
| CVA | 5 | 158 | 3.2 |
| Cardiac arrest | 28 | 917 | 3.1 |
| Other | 8 | 275 | 2.9 |
| Acute pulmonary oedema | 10 | 422 | 2.4 |
| Asthma | 3 | 138 | 2.2 |
| Total | 93 | 2343 | 4.0 |

CVA cerebrovascular accident

This paper aims to identify the reasons for difficult airways in emergency medicine practice as well as to study the rescue methods used in a tertiary hospital in South-East Asia.

Methods

The study site emergency department has an ongoing airway registry that prospectively captures patient demographics, diagnosis, indications for intubation, persons and discipline of intubating physicians, number of attempts, method of intubation including rescue methods, reasons for difficult intubation, success rates and complications. Data are collected using a study form, which is completed by the intubating physician immediately after the procedure. Where the data were incomplete, the research assistant would approach the intubating physician to fill the gaps. This project was approved by the hospital's Ethics Committee.

The data used for this study were from 1 January 2000 to 31 December 2006. The data were analysed using the Statistical Package for the Social Sciences (SPSS) software for Windows (version 10.1; SPSS Inc).

Table 2 Reasons for difficult intubation

| Reasons for difficulty | No. | % |
|---|-----|------|
| Anterior larynx | 38 | 40.9 |
| Neck immobility | 22 | 23.7 |
| Secretions and blood | 14 | 15.1 |
| Small mouth < 3 fingerbreadths | 13 | 14.0 |
| Obesity | 10 | 10.8 |
| Incomplete frontal dentition | 8 | 8.6 |
| Airway oedema | 8 | 8.6 |
| Oral obstruction (tumour, mechanical obstruction) | 7 | 7.5 |
| Maxillofacial trauma | 4 | 4.3 |
| Combativeness | 2 | 2.2 |

Table 3 Personnel performing the first intubation and rescue attempts

| Personnel | First | Rescue |
|---------------------|------------|------------|
| Emergency physician | 85 (91.3%) | 64 (68.8%) |
| Anaesthetist | 2 (2.2%) | 21 (22.6%) |
| Surgeon | 2 (2.2%) | 5 (5.4%) |
| Critical care | 4 (4.3%) | 3 (3.2%) |
| Total | 93 (100%) | 93 (100%) |

Definitions

For the purpose of this study, we adopted the following definitions:

1. A difficult airway is one where there was difficulty administering adequate mask ventilation or if there were at least three attempts at orotracheal intubation or a failed intubation or if cricothyroidotomy was difficult.
2. A failed airway is one where tracheal intubation cannot be achieved, after multiple attempts, by the orotracheal or nasal-tracheal or transtracheal (cricothyroidotomy or tracheostomy) route or attempts at intubation are abandoned.

Results

From 2000 to 2006, there were a total of 808,721 emergency department (ED) visits; 2,343 of them required advanced airway intervention, giving a rate of 2.9 per 1,000 emergency department visits. Ninety-three (4.0%) of these were deemed difficult intubations, seven (0.3%) of which were failed airways. The mean age of the patients was 57 years for patients with difficult intubations compared to 63 years for all patients in the registry. The gender ratio was 75.5% men in the difficult airway group compared to 66.5% men among all patients.

The most common indications for intubation were cardiac arrest (39.1%), acute pulmonary oedema (18.0%) and trauma (13.2%). However, the most common diagnoses resulting in difficult intubations were seizure (16.7%), burns (14.7%) and pneumonia (12.3%) (Table 1).

Table 4 Methods of intubation for the first and final attempts

| Method | First attempt | Final attempt |
|---------------------|---------------|---------------|
| OTI, no medications | 46 | 43 |
| OTI, induction | 11 | 9 |
| RSI | 35 | 34 |
| Cricothyroidotomy | 1 | 3 |
| Tracheostomy | 0 | 4 |

OTI orotracheal intubation, RSI rapid sequence intubation

Table 5 Rescue devices

| Rescue device | No. | % |
|---------------------------------------|-----|------|
| Laryngoscope, curved blade | 51 | 54.8 |
| Laryngoscope, curved blade and bougie | 24 | 25.8 |
| GlideScope | 6 | 6.5 |
| Formal tracheostomy | 4 | 4.3 |
| LMA | 3 | 3.2 |
| Cricothyroidotomy | 3 | 3.2 |
| Laryngoscope, straight blade | 2 | 2.2 |

LMA laryngeal mask airway

The three most common reasons cited for difficult intubations were the presence of an anterior larynx (40.9%), neck immobility (23.7%) and profuse oral secretions and bleeding (15.1%) (Table 2). The Mallampati score was seldom used.

The mean number of attempts at intubation was 3.6 for the difficult airway group and 1.2 for all patients in the registry.

Emergency physicians were most likely to attempt difficult intubations first (91.3%) and were most likely to also perform the rescue attempt (68.8%). Anaesthetists performed 22.6% of rescue airways (Table 3).

Of the 46 patients who underwent orotracheal intubation with no drugs, 3 were converted to surgical airways (2 cricothyroidotomies and 1 tracheostomy). Of the 11 patients who underwent orotracheal intubation with induction agents only 2 had to receive neuromuscular blocking agents subsequently through rapid sequence intubation (RSI). Three of the patients who initially had RSI subsequently had tracheostomies performed by the surgeons (Table 4).

The most common rescue device used in our department was the Macintosh-type laryngoscope with the curved blade alone (54.8%), followed by the laryngoscope with the bougie (25.8%) and the GlideScope (6.5%) (Table 5). Most of the bougie attempts were made by anaesthetists (83.3%).

There were seven failed airways but no deaths attributed to the failures (Table 6). The mortality rate of 40.5% among

patients with difficult airways was not different from that of all patients who had airway management (41.0%). There were four cricothyroidotomies and four tracheostomies. The surgical airway rate was 0.3%. Three of the cricothyroidotomies were performed by emergency physicians while the rest of the surgical airways were performed by surgeons. There was one failed cricothyroidotomy in a female patient with previous radiation therapy to the head and neck. Her airway was subsequently secured with orotracheal intubation with a bougie by an anaesthetist. She had a Cormack-Lehane grade 3 larynx. There was no “unable to ventilate-unable to intubate” situation.

Discussion

The difficult airway is a challenge to both the emergency physician and the anaesthetist. Its incidence in the ED is understandably higher as there is a disproportionately larger number of patients requiring airway management as a result of acute medical or surgical conditions which by themselves contribute to the difficulty. Examples of these would be maxillofacial trauma, respiratory burns and the various causes of laryngeal oedema. Airway management in the ED often occurs in an unpredictable and uncontrolled environment, sometimes with the patient arriving unannounced. The unique situation of having a high proportion of difficult airways and an unpredictable environment affords the emergency physician the opportunity to become an expert in emergency and difficult airway management.

The difficult airway might be considered in three areas: difficult bag-mask ventilation, difficult intubation and difficult surgical airway. The difficult bag-mask ventilation scenario would generally preclude paralysis with neuromuscular blocking agents but it does not imply difficulty in intubation. Reasons for difficult ventilation include difficult mask fit, obesity, obstruction, age over 65, “no teeth” and

Table 6 Failed emergency department airways

| Case no. | Diagnosis | No. attempts | Personnel | Reasons | Outcome |
|----------|---|--------------|------------|--|--------------------|
| 1 | Chronic renal failure with acute pulmonary oedema | 3 | EM, AN | Obesity, small mouth, anterior larynx | Admitted, dialysis |
| 2 | Cardiac arrest | 1 | EM | Small mouth | Died |
| 3 | Cardiac arrest | 6 | EM, AN | Neck scarring, oedematous airway, secretions | Died |
| 4 | Pneumonia | 6 | EM, AN, GS | Subglottic stenosis | Tracheostomy in OT |
| 5 | Cardiac arrest | 6 | EM, AN | Anterior larynx, grade 4 | Died |
| 6 | Cardiac arrest | 1 | EM | Small mouth, rigor | Died |
| 7 | Cardiac arrest | 3 | EM | Anterior larynx | Died |

EM emergency medicine, AN anaesthesia, GS general surgery, OT operating theatre

“stiff lungs”. This difficulty is generally not measured, but rather, it is the “unable to ventilate and unable to intubate” scenario that is considered the true difficulty. We did not encounter this in our study. This is not unexpected as its incidence rate is often quoted to be low and is rarely quantified [9, 12, 13]. There is a role for the use of supraglottic devices, e.g. the laryngeal mask airway (LMA) or Combitube or laryngeal tube, in some of these cases especially in the obese, elderly and edentulous and for those with difficult mask fit [14].

Our difficult intubation rate was 4% while our failed intubation rate was 0.7%. This compares with 2.7–12.3% cited in the emergency medicine literature [5–9, 15] and 0.13–4% in the anaesthesia literature [1–3]. Among the 93 difficult intubations, 78 (83.9%) were due to an anterior larynx, neck immobility, obesity and incomplete frontal dentition. Video laryngoscopy shows promise in overcoming these difficulties. Our department acquired the GlideScope® in November 2005. However, there was a learning phase and the results in 2006 did not reflect a downward trend in the incidence of difficult airway. It would be interesting to study the effect of video laryngoscopy on difficult airways and whether the incidence falls with its use. This would entail prolonging the duration of our study beyond the duration of the learning phase.

Our surgical airway rate was 0.3%, half of which were cricothyroidotomies and half were tracheostomies. Our surgeons generally prefer to perform tracheostomies when called to secure the difficult airway. The cricothyroidotomy rate among other ED are between 0.6 and 0.9% [4, 15, 16, 21–23]. We had one failed cricothyroidotomy. The causes of difficult cricothyroidotomy include anterior neck swellings, infections, obesity, post-radiation therapy as well as main stem bronchial and tracheal injuries. The incidence of difficult surgical airways is unknown.

While the recognition of a difficult airway is important, the authors believe that the value of skills acquisition, well-prepared airway strategies and equipment innovation cannot be overemphasized. Various studies [15–21] have shown that experience and the use of modern airway equipment do improve intubation success rates; however, it would be difficult to study the effect of having planned strategies or algorithms in airway management.

Limitations

Although this was a prospective observational study, there were several limitations. Incomplete documentation was the most common problem and was present in 16% of our study forms. There was also a possibility of underdeclaration of the number of attempts at intubation or any complications or adverse events. The research assistant

however did attempt to clarify any ambiguity with the primary intubators retrospectively in order to get as accurate a documentation as possible. This was done within 1 week of the intubation. There was also the possibility of incomplete capture of all intubations performed in the department. The researchers tried to minimize this by counterchecking with the trauma registry and mortality records every week.

With regard to attempting to qualify why certain intubations were difficult, physicians would often label an airway as “anterior” rather than to document whether the thyromental or thyrohyoid distance was small. Future studies should be designed to have more specific data fields on the various components contributing to the difficult airway. In addition, with the advancement of medical technology, it would be interesting to study if the number of attempts at intubation and the difficult and failed airway rates would decline.

Conclusions

Emergency physicians manage most difficult airways (68.8%) successfully. The success rate by the emergency physicians can be further improved through the more frequent use of the bougie or other rescue device like video laryngoscopy. A possible suggestion would be for the emergency physician to use the bougie after the second or third attempt at direct orotracheal intubation.

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