



Clinical Paper

Tracheal intubation in an urban emergency department in Scotland: A prospective, observational study of 3738 intubations



Dean Kerlake, Angela J. Oglesby, Nicola Di Rollo, Ed James, Dermot W. McKeown, David C. Ray*, on behalf of the EDIR investigators¹

Departments of Emergency Medicine, Anaesthesia and Critical Care, Royal Infirmary, Little France Crescent, Edinburgh EH16 4SA, Scotland, UK

ARTICLE INFO

Article history:

Received 24 September 2014

Received in revised form

28 November 2014

Accepted 13 January 2015

Keywords:

Airway management, Emergency

Tracheal intubation

Emergency department

Outcomes

Complications

ABSTRACT

Aim: The emergency department (ED) is an area where major airway difficulties can occur, often as complications of rapid sequence induction (RSI). We undertook a prospective, observational study of tracheal intubation performed in a large, urban UK ED to study this further.

Methods: We reviewed data on every intubation attempt made in our ED between January 1999 and December 2011. We recorded techniques and drugs used, intubator details, success rate, and associated complications. Tracheal intubation in our ED is managed jointly by emergency physicians and anaesthetists; an anaesthetist is contacted to attend to support ED staff when RSI is being performed.

Results: We included 3738 intubations in analysis. 2749 (74%) were RSIs, 361 (10%) were other drug combinations, and 628 (17%) received no drugs. Emergency physicians performed 78% and anaesthetists 22% of intubations. Tracheal intubation was successful in 3724 patients (99.6%). First time success rate was 85%; 98% of patients were successfully intubated with two or fewer attempts, and three patients (0.1%) had more than three attempts. Intubation failed in 14 patients; five (0.13%) had a surgical airway performed. Associated complications occurred in 286 (8%) patients. The incidence of complications was associated with the number of attempts made; 7% in one attempt, 15% in two attempts, and 32% in three attempts ($p < 0.001$).

Conclusion: A collaborative approach between emergency physicians and anaesthetists contributed to a high rate of successful intubation and a low rate of complications. Close collaboration in training and delivery of service models is essential to maintain these high standards and achieve further improvement where possible.

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1. Introduction

Emergency airway management is often required in critically ill and injured patients who present to the emergency department (ED). Rapid sequence induction (RSI) and tracheal intubation is the method of choice for securing the airway in the majority of cases. Historically, ED RSI in the United Kingdom has been performed mostly by anaesthetists,¹ but it is increasingly becoming the responsibility of emergency physicians. RSI and tracheal intubation are considered core skills for trainees in emergency medicine.² However, previous UK studies have found emergency physicians are involved in only 20–50% of RSIs in the ED.^{3–5}

Tracheal intubation in the critically ill and injured can be difficult.^{6,7} The fourth National Audit Project (NAP4) from the Royal College of Anaesthetists found at least one in four major airway events occurred in the ED or intensive care unit (ICU), often with particularly adverse outcomes, and that most events in the ED were complications of RSI.⁸ The need to scrutinise current practice to improve quality in ED airway management has been highlighted recently.⁹

Techniques and practices in emergency airway management vary internationally. Studies from North America and Asia have demonstrated variable success and complication rates of RSI performed by emergency physicians.^{10–17} There are limited data from the UK^{4,5} so we reviewed our continuous registry of intubations in a large UK ED to characterise intubation sequences, success and complications. Our aims were to describe why, how and by whom ED patients were intubated, and to document the rates of successful intubation and complications related to the procedure.

* Corresponding author.

E-mail address: david.ray@nhslothian.scot.nhs.uk (D.C. Ray).

¹ See Appendix A for Emergency Department Intubation Registry (EDIR) investigators.

2. Methods

The Scientific Officer of the South East Scotland Research Ethics Service stated that formal ethical approval was not required for this case series.

2.1. Setting and patients

The Royal Infirmary of Edinburgh (RIE) is a large, urban, teaching hospital which serves a population of around 800,000. In 1999 around 50,000 patients attended the ED; this has now risen to around 115,000 each year. Patients younger than 13 years of age are generally managed in a separate children's hospital. Emergency tracheal intubation is managed jointly by emergency physicians and anaesthetists. There is a protocol (see Appendix B) which requires that an appropriately senior anaesthetist is contacted to attend (if available) when drug-assisted intubation is being performed. The anaesthetist generally remains in reserve while the emergency physician proceeds with induction and tracheal intubation. However if the anaesthetist determines for an individual case that it would be more appropriate, they will perform induction and tracheal intubation themselves. We included all patients who underwent any attempt at tracheal intubation in the ED between January 1999 and December 2011, including those intubated without drugs.

2.2. Data collection and analysis

We have recorded prospectively data about all tracheal intubation attempts performed in the ED in an intubation registry since January 1999. This registry was initially established as part of a 2-year multi-centre observational study of RSI in seven Scottish emergency departments.⁵ The intubating doctor records data on a specifically designed proforma immediately after attempting tracheal intubation. Investigators regularly check the resuscitation room log and electronic records to ensure all patients are included. If a proforma is not completed, a form is sent to the intubating doctor for completion; if the intubating doctor cannot be identified, an investigator completes the form using data from the patient's ED clinical notes. Records are reviewed by a senior emergency physician (AJO) and senior anaesthetist (DCR or DWMcK) to identify trends and patients for discussion. We document details in three main sections: patient details and pre-induction physiology; details of the intubation procedure; and immediate complications or events associated with tracheal intubation (Table 1). We recorded desaturation or hypotension as a complication only if SpO₂ was >90% or systolic blood pressure >90 mmHg before intubation was performed. We did not record oesophageal intubation as a complication if it was recognised immediately. Data were entered by independent audit staff from the Scottish Trauma Audit Group into a Microsoft Excel™ database. We used GraphPad Prism™ to perform basic descriptive statistical analyses and used the χ^2 test or Fishers exact test as appropriate to compare differences between groups. We considered a p value of <0.05 as significant.

3. Results

During the study period approximately 1.1 million patients attended the ED and 3988 patients had tracheal intubation attempted; this equates to almost six intubations per week and 1 in 275 (0.36%) ED attendances. In 250 patients there was no record of whether drugs were given to facilitate tracheal intubation; we excluded these patients from further analysis. Thus, we analysed data from 3738 patients. 2749 patients (74%) received RSI (administered an induction drug and suxamethonium or rocuronium), and a further 361 patients (10%) received other drug combinations (27

Table 1

Data collected for each tracheal intubation attempt.

<i>Patient details and pre-induction physiology</i>
Age and gender of the patient
Primary diagnosis – classed as trauma; medical; neurological; cardiorespiratory; toxicology; in cardiac arrest; other
Heart rate <40 or >140 beats per minute
Respiratory rate <6 or >30 breaths per minute
Oxygen saturation <90% despite supplemental oxygen
Systolic blood pressure <90 mmHg
Glasgow coma scale score <9
Any anticipated difficulty of intubation
<i>Details of the intubation procedure</i>
Time of intubation
Use of pre-oxygenation (3 min with a tight-fitting face-mask)
Use of cricoid pressure
Use of induction drugs and neuromuscular blocking drugs (dose not recorded)
Grade and specialty of intubating doctor
Grade and specialty of supervising doctor
Best laryngoscopic view obtained (Cormack and Lehane classification)
Adjuncts used – classed as stylet; bougie; external laryngeal manipulation; capnography; other
<i>Immediate complications or events associated with tracheal intubation</i>
Hypoxaemia (SpO ₂ <90%)
Hypotension (SBP < 90 mmHg)
Cardiac arrest
Vomiting or regurgitation of gastric contents
Need for surgical airway

induction drug and atracurium or vecuronium; 184 induction drug but no neuromuscular blocking drug; 12 neuromuscular blocking drug and an opioid; 77 suxamethonium but no induction drug and eight another neuromuscular blocking drug but no induction drug; 27 inhalational induction with sevoflurane; four only an opioid; four topical administration of lidocaine spray; and 18 were recorded as “non-RSI” where drugs were given but not specified). 628 patients (17%) had intubation performed without administration of any induction, opioid or neuromuscular blocking drug; 496 of these patients (30 of whom were in traumatic cardiac arrest) underwent attempted tracheal intubation during resuscitation for cardiac arrest.

3.1. All intubations

The median age (range) of patients was 48 years (1–102), and 64% were male; nine patients were aged less than 13 years. Three quarters of intubation attempts occurred between the hours of 0800 and 2400. The presenting diagnostic categories for patients are shown in Table 2. More than 50% of patients had a medical diagnosis, a further one-fifth was in cardiac arrest, and one-quarter had a diagnosis of trauma.

The specialty of the primary intubator was emergency medicine in 78% and anaesthesia in 22%. Tracheal intubation was successful in 3724 patients (99.6%). Overall first-time successful tracheal intubation rate was 85% (anaesthetists 92%, ED consultants 94%, ED trainees 83%; $p < 0.001$). The rate of first-time successful intubation was related to the presenting diagnosis (trauma 84%; cardiac arrest 79%; medical 87%; neurological 88%; cardiorespiratory 86%; toxicology 91%; and other 96%, $p < 0.001$). We separated patients into one of three groups according to drugs: RSI; other drug combinations; and no drugs given. Details for successful tracheal intubation rates and specialty of the primary intubator are shown in Table 3. Successful intubation was more likely on the first attempt if RSI was used ($p < 0.001$). Unsurprisingly anaesthetists were involved most commonly in patients given RSI and least commonly in patients given no drugs to facilitate intubation. Tracheal intubation was achieved within two attempts in 98% of patients. Three patients (0.1%) had more than three attempts to successfully intubate the trachea. Intubation was not successful in a further 14 patients; one

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