



Clinical paper

Cricoid pressure and laryngeal manipulation in 402 pre-hospital emergency anaesthetics: Essential safety measure or a hindrance to rapid safe intubation?☆

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ABSTRACT

Objectives: This is the first study to look at the effects of cricoid pressure/laryngeal manipulation on the laryngeal view and intubation success in the emergency or pre-hospital environment. Cricoid pressure is applied in the hope of reducing the incidence of aspiration. However the technique has never been evaluated in a randomized trial and may adversely affect laryngeal view. In order to improve intubating conditions cricoid pressure may be released and the larynx manipulated into a more favourable position.

Methods: We carried out a prospective observational study to evaluate the effects of cricoid pressure and laryngeal manipulation on laryngeal view in our physician led pre-hospital trauma service.

Results: 402 patients were included over a 16-month period. We intubated 98.8% patients on the first or second attempt. In 61 intubations (in 55 patients, 13.6%) the larynx required manipulation to facilitate intubation. In 22 intubations cricoid pressure was removed with the laryngeal view improving in 50%. Bimanual laryngeal manipulation was used in 25 intubations and the larynx better visualised in 60% of these. Backwards upwards rightwards pressure was applied to the larynx in 14 intubations and the laryngeal view improved in 64%. Two patients regurgitated when cricoid pressure was released. Both had prolonged periods of bag valve mask ventilation and difficult intubations.

Discussion: The results suggest that cricoid pressure should be removed if the laryngeal view obtained is not sufficient to allow immediate intubation. Further manipulation of the larynx is likely to improve the chances of successful tracheal tube placement.

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1. Introduction

The importance of good pre-hospital airway management is uncontroversial but the exact techniques by which this can be achieved are often debated. In particular, the value and potential drawbacks of pre-hospital rapid sequence induction (RSI) and tracheal intubation has been the subject of great concern in recent years.^{1–5} In a comprehensive review of the evidence for tracheal intubation in patients with traumatic injury the lack of high quality evidence was emphasized.⁶ The authors suggested that ‘future investigations should focus on the development and monitoring of tracheal intubation strategies in emergency medical services (EMS) systems. This includes the implementation of mechanisms to pro-

vide safe and effective orotracheal intubation, often with the need for drug-assistance’. The authors discuss the use of cricoid pressure (CP) as part of an RSI technique, describing it as one of the ‘enhancements for safe and effective emergency tracheal intubation in trauma’. When this review and guidelines were published there were 21 available studies of trauma patients undergoing emergency tracheal intubation which encouraged routine application of CP. The American College of Emergency Physicians and the National Association of EMS Physicians recommend the application of CP during emergency tracheal intubation in trauma patients. This is also routine practice in most European countries. The routine application of CP has been recently challenged with evidence linking it to impaired laryngeal view, less effective bag mask ventilation and unproven efficiency in reducing the incidence of aspiration/regurgitation.⁷ The use of CP in the pre-hospital trauma patient may make an already challenging environment more difficult, potentially worsening intubating conditions for little proven gain. It is likely that these issues apply equally to intubation in the emergency department but only pre-hospital data was collected for this study.

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1.1. Goals of this investigation

This study was performed prospectively as part of a service evaluation of physician led RSI in an urban trauma service. The purpose of this paper was to prospectively establish the use and effects of laryngeal manoeuvres on the probability of successful laryngeal intubation. We investigated the incidence of difficult laryngoscopy in our population. Where difficulty was encountered, the effect of cricoid release, with or without further laryngeal manipulation, on laryngoscopic view, success at intubation and airway contamination were recorded.

2. Methods

2.1. Study setting

London HEMS (Helicopter Emergency Medical Services) is a pre-hospital trauma service, which delivers a doctor–paramedic team with critical care capability to incidents in an urban area with a population of up to 10 million. It operates by helicopter during the day and fast response car at night. All patients with clinical evidence of a cardiac output are intubated using a similar RSI method as described below.

2.2. Study interventions

Institutional ethical approval was sought but, since there were no study interventions or deviations from routine practice and the study was a service evaluation, it was not required. The project was registered as a service evaluation along local guidelines. Each aspect of service delivery including pre-hospital anaesthesia is performed to defined standard operating procedures (SOPs). The pre-hospital emergency anaesthesia SOP is shown in [Appendix A](#). Patients are anaesthetised and their trachea's intubated if there is actual or impending airway compromise, a failure of ventilation or oxygenation, coma, agitation such that transport by air would endanger the patient or crew, predicted clinical course or for humanitarian reasons. The majority of our case mix is falls from height, road traffic emergencies and penetrating disease by knife. The importance of obtaining the best possible intubating conditions for the initial intubation attempt is stressed in training. Prior to intubation the patient is placed in a position allowing 360° access. Etomidate (0.3 mg kg⁻¹ if normotensive, 0.2 mg kg⁻¹ if hypotensive) is used for induction and suxamethonium for initial neuromuscular blockade. Sedation is maintained with morphine/midazolam, in 1–2 mg aliquots titrated to observations and transport time, and, neuromuscular blockade with pancuronium (0.1 mg kg⁻¹). All intubations are performed using a gum elastic bougie (Pro-breath, tracheal tube introducer, Well Lead Medical Co., Ltd., Panyu, China). The cricoid ring is identified by the lead doctor and CP applied by a paramedic assistant. CP is applied by one-handed technique with onset of anaesthesia in all cases undergoing RSI. The emphasis is on rapid intubation rather than obtaining an ideal laryngeal view.

If the cords are not seen or the bougie cannot be passed between the cords a series of '30 s drills' are instituted ([Appendix A](#)), which include three methods of laryngeal manipulation. To facilitate intubation the operator may remove CP, then either ask an assistant for backwards upwards rightwards pressure (BURP) to be applied to the larynx or manipulate the larynx under direct vision (BLM).

If these manoeuvres are not successful then the patient or intubator position is changed; if the oxygen saturation falls below 92% the attempt at intubation is abandoned and the patient re-oxygenated using bag mask ventilation. If the patient cannot then be ventilated, a Proseal laryngeal mask™ (Intavent, Orthofix Ltd., Maidenhead, UK) is inserted or a surgical airway performed.

2.3. Study design and selection of participants

A database was set up to prospectively collect information on advanced airway interventions over a 16-month period (from 1st January 2006 to 31st May 2007). Data was collected on all adult patients requiring intubation attended by London HEMS. Doctors were either permanent consultant staff or senior trainees who worked in the service for around 6 months. The trainees were recruited from emergency medicine, critical care or anaesthesia. They all had at least 4 years of postgraduate experience in their primary speciality.

2.4. Methods of measurement and data collection

Duty doctors completed a standardised paper questionnaire after each mission. Physiological observations were obtained using the routine mission monitor printouts (Propaq Encore®, Welch Allyn, Protocol Incomp. Beaverton, OR, USA). Data collected included whether the operator predicted difficult laryngoscopy, the use of laryngeal manoeuvres, the number of attempts at intubation, the presence of airway contamination, the grade of laryngeal view (after Cormack-Lehane⁸) and complications of the procedure. Diagrams of the Cormack and Lehane (CL) laryngeal view grading were provided on the data collection sheet. An attempt at intubation was defined as initial laryngoscopy combined (if required) with a '30 s drill'. Removal of the laryngoscope, further pre-oxygenation and a repeat attempt at laryngoscopy was defined as a second attempt. An improvement in laryngoscopy was defined as a change in one or more on the CL scale. Airway contamination was defined as blood, vomitus, malplacated tissue or foreign bodies identified in the pharynx or larynx by the intubator. Regurgitation was defined by the visualisation of gastric contents in the pharynx/larynx on removing CP.

Data was then transferred to and stored in Microsoft Excel spread sheets and Word documents (Microsoft Office 2004, Seattle, WA).

2.5. Statistical analysis

All analysis was carried in SAS® version 9.2. Fisher's exact tests were used when frequency counts were less than 5; otherwise a standard Chi-squared test was used. Overall tests were computed using the Mantel Haenszel's test Statistic that provided a test of overall statistical significance between any two variables. The 95% confidence intervals for the odds ratios as estimates of relative risk (when appropriate) are presented along with the point estimates. Multiplicity adjustments were not carried.

3. Results

3.1. Characteristics of study subjects

In the study period 481 patients were intubated at scene. Four hundred and two were intubated by the London HEMS doctor–physician team and are included in the study (see [Table 1](#)).

One patient with burns required three attempts at intubation as the oedematous cords did not allow passage of the initial 8 mm tracheal tube and a subsequent 7 mm tube had a cuff failure. One patient was intubated first pass but the cuff failed and a larger tracheal tube could not be passed while a third attempt at intubation with a smaller tube was successful. One surgical airway was performed as a result of failure to intubate and ventilate. This patient was a motorcyclist in cardiac arrest with facial fractures, a mandibular fracture, a large tongue laceration and a probable laryngeal fracture. The copious blood in the airway and facial distortion made bag mask ventilation ineffective and after two attempts at oral intubation (with no use of CP, BURP or BLM due to suspected

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