Laryngoscopic views during rapid sequence intubation in the emergency department

Colin A. Graham, MPH, FRCSEd, FRCSGlasg, FFAEM;[*] Angela J. Oglesby, FRCSEd FFAEM;[†] Diana Beard, MBA;[‡] Dermot W. McKeown, FRCA FRCSEd[§]

ABSTRACT

Objectives: Our objective was to document and compare the views obtained at laryngoscopy during emergency department (ED) rapid sequence intubation (RSI) by anesthetists and emergency physicians of varying seniority and experience.

Methods: Data were prospectively collected on every intubation attempt in 7 urban Scottish EDs for 2 calendar years, commencing Jan. 11, 1999. Data included patient's age, gender, grade and specialty of intubator, laryngoscopic grade, and number of intubation attempts. Quality of laryngoscopic visualization was graded using the Cormack–Lehane scale, with grades I and II considered good visualization. A descriptive analysis was performed, and key statistical comparisons made.

Results: During the study period, 735 patients underwent RSI, and grade of intubation was documented in 672 cases (91%). In total, 68.2%, 23.4%, 6.1% and 2.4% of the intubations were classified as Cormack–Lehane grade I, II, III and IV respectively. Overall, anesthetists and anesthesia trainees achieved good laryngoscopic visualization in 94.0% of cases (95% confidence interval [CI], 90.8%–96.4%) and emergency physicians and emergency medicine trainees did so in 89.2% of cases (95% CI, 85.5%–92.3%; $p = 0.027$). Specialist registrars and senior house officers in anesthesia were more likely to obtain good visualization than their emergency medicine counterparts ($p = 0.034$ and 0.035 respectively). Consultants in emergency medicine were more likely to obtain good views than their anesthesia counterparts, but this difference was not statistically significant.

Conclusions: Anesthetic trainees obtain better laryngoscopic views than emergency medicine trainees, but these differences disappear with increasing emergency physician seniority, suggesting a training and experience effect. Emergency medicine trainees may benefit from additional focus on laryngoscopic visualization techniques early in their training period.

Key words: Laryngoscopy; emergency department; rapid sequence intubation; anaesthetists; emergency physicians; training

RÉSUMÉ

Objectifs : Nous voulions documenter et comparer les opinions réunies au moment d'une laryngoscopie pratiquée au cours de l'induction d'une anesthésie à séquence rapide (ISR) réalisée à l'urgence par des anesthésistes et des médecins d'urgence dont l'ancienneté et l'expérience variaient.

Méthodes : On a recueilli des données de façon prospective au cours de chaque tentative d'intu-

*Specialist Registrar in Accident & Emergency Medicine, Southern General Hospital, Glasgow, Scotland
†Consultant in Accident & Emergency Medicine, Royal Infirmary of Edinburgh, Old Dalkeith Road, Edinburgh, Scotland
‡Director, Scottish Trauma Audit Group, Royal Infirmary of Edinburgh, Edinburgh, Scotland
§Consultant in Anaesthesia & Intensive Care Medicine, Royal Infirmary of Edinburgh, Edinburgh, Scotland

Received: June 17, 2003; final submission: Aug. 13, 2004; accepted: Sept. 3, 2004

This article has been peer reviewed.

Can J Emerg Med 2004;6(6):416-20

bation effectuée dans sept services d'urgence urbains en Écosse pendant deux années civiles à compter du 11 janvier 1999. Les données comprenaient l'âge du patient, son sexe, le niveau et la spécialité de l'intubateur, la catégorie laryngoscopique et le nombre d'essais d'intubation. On a évalué la qualité de la visualisation laryngoscopique au moyen de l'échelle de Cormack–Lehane, les niveaux I et II étant considérés comme une bonne visualisation. On a procédé à une analyse descriptive et effectué des comparaisons statistiques clés.

Résultats : Au cours de la période d'étude, 735 patients ont subi une ISR et l'on a documenté la qualité de l'intubation dans 672 cas (91 %). Au total, 68,2 %, 23,4 %, 6,1 % et 2,4 % des intubations ont été classées comme des intubations des catégories I, II, III et IV respectivement selon l'échelle de Cormack–Lehane. Dans l'ensemble, les anesthésistes et les stagiaires en anesthésie ont produit une bonne visualisation laryngoscopique dans 94,0 % des cas (intervalle de confiance [IC] à 95 %, 90,8 %–96,4 %) et les médecins d'urgence et les stagiaires en médecine d'urgence l'ont fait dans 89,2 % des cas (IC à 95 %, 85,5 %–92,3 %; p = 0,027). Les spécialistes et les anesthésistes internes principaux étaient plus susceptibles de produire une bonne visualisation que leurs homologues du secteur de la médecine d'urgence (p = 0,034 et 0,035 respectivement). Les médecins-conseils en médecine d'urgence étaient plus susceptibles de produire de bonnes visualisations que leurs homologues en anesthésie, mais la différence n'était pas statistiquement significative.

Conclusions : Les stagiaires en anesthésie produisent de meilleures vues laryngoscopiques que les stagiaires en médecine d'urgence, mais ces écarts disparaissent avec l'ancienneté des médecins d'urgence, ce qui indique que la formation et l'expérience ont un effet. Les stagiaires en médecine d'urgence peuvent bénéficier d'une concentration supplémentaire sur les techniques de visualisation laryngoscopique au début de la période de formation.

Introduction

Provision and maintenance of an adequate airway is fundamental for resuscitation and is said to be "the defining skill of emergency medicine."[1] In some emergency departments (EDs) in the United Kingdom (UK) there is an increasing trend for advanced emergency airway management (with anesthetic and neuromuscular blocking drugs) to be a shared responsibility between emergency physicians (EPs) and anesthetists.[2,3] In such EDs, anesthetists will usually be called prior to rapid sequence intubation (RSI), and the anesthetist and EP will determine by consensus the most appropriate intubator from the 2 specialties. In the event that the duty anesthetists are occupied with other cases, and if there is a clinical requirement for immediate RSI, the anesthetists will be notified but the EP, if appropriately trained, may proceed with RSI independently. A senior anesthetist would usually be asked to be present during, or perform, the intubation in cases where a difficult airway is anticipated, although EPs would proceed with RSI in time-critical scenarios where immediate intervention is necessary.

The Cormack–Lehane[4] classification of views obtained at laryngoscopy is helpful in predicting the difficulty of intubation. Grade I describes a view of most or all of the glottis; grade II describes a view of the posterior part of the glottis only; grade III a view of only the epiglottis; and grade IV a view where the glottis and epiglottis are not visible at all. Grades I and II are associated with low intubation failure rates, grades III and IV with higher failure rates. In the operating room, poor views (grade III or IV) occur in approximately 1%–4% of cases, but these are associated with failure to intubate in only 0.05%–0.35% of cases.[5] The incidence of poor visualization and difficult intubation in the ED is unknown, but a recent review suggests that the rate may be between 1% and 30%.[5] In a previous prospective observational study[6] we assessed laryngoscopic views obtained by different specialists during RSI in the ED. In the present group of 735 patients, the first-attempt specialty was emergency medicine (EM) in 377 cases (51.5%) and anesthesia in 355 cases (48.5%). Grade of laryngoscopy was documented in 672 cases (91%). Good views, defined as Cormack–Lehane grades I and II, were obtained in 316 of 354 initial EP attempts (89.3%), and in 298/317 (94.0%) initial anesthesia attempts (p = 0.039, chi-squared test).

No specific data exist on the incidence of difficult intubation in the ED, stratified by Cormack–Lehane grading. Our objective in this study was to compare the ability of anesthetists and EPs of varying seniority and experience to achieve good laryngoscopic visualization, defined as Cormack–Lehane grades I and II. Our secondary objective was to report the use of intubation adjuncts as a proxy marker for difficult intubation by the 2 groups.

Methods

Design and setting

This multicentre prospective observational study took

https://doi.org/10.1017/S1481803500009416 Published online by Cambridge University Press

place between January 1999 and January 2001 in the EDs of 7 urban Scottish teaching hospitals.

Conduct

The files of every patient on whom endotracheal intubation had been attempted in the ED were reviewed, but only adult patients who underwent RSI were included in this analysis. Data collected included the patient's age, gender, number of attempts before su ccessful intubation, the Cormack–Lehane grade[4] observed on each intubation attempt, level and specialty of intubating doctor, adjuncts used for intubation (e.g., stylets and gum-elastic bougies) and immediate complications.

Data were collected on a dedicated proforma, which included detailed descriptions of the 4 Cormack–Lehane grades, to allow physicians who were unfamiliar with the grading system to allocate a grade for each intubation. No specific training on the Cormack–Lehane grading system was given to physicians completing the forms.

Intubations by anesthetists and intensive care doctors were all classified as anesthesia intubations. This was because in the study hospitals almost all intensivists are also anesthetists. Because this was an observational study of current practice, no restrictions were placed on the techniques or drugs used to facilitate intubations. During the planning phase, advice was sought and ethical approval was deemed unnecessary because of the observational nature of the study.

Definitions

In the UK, a consultant is a fully trained medical specialist with at least 8 years of postgraduate medical training prior to appointment. A specialist registrar is a senior doctor, equivalent to a senior resident in North America, who has at least 4 years of postgraduate experience and is training to be a specialist. Specialist registrars range from postgraduate year (PGY) 4 to 10. A staff grade doctor is a doctor with several years of postgraduate experience in a non-training (i.e., clinical service) ED post. Staff grade doctors are often very experienced doctors, many of whom have 10–15 years of postgraduate experience. A senior house officer is a junior doctor in basic postgraduate training, usually with 1 to 4 years postgraduate experience (equivalent to PGY 2–5). Although senior house officers are relatively junior, they may undertake acute emergency duties in hospital, unsupervised by resident senior staff, if deemed competent.

Data analysis

A descriptive analysis was performed, and comparisons (Mann–Whitney *U* test and chi-squared test for non-parametric time based data and parametric data respectively), were made using SPSS v12.0. Where appropriate, 95% confidence intervals (CIs) are given. Statistical significance was set at $p < 0.05$.

Results

Table 1 compares baseline characteristics for the 2 groups, including median age, time of ED presentation, and proportion of trauma patients treated by EPs and anesthetists. Table 2 summarizes laryngoscopic visualization outcomes for EPs and anesthetists, stratified by patient type. These data suggest that anesthetists obtained better views than EPs for trauma patients and for patients with head injury.

Table 3 shows the percentage of cases in which a good view was obtained (Cormack–Lehane grades I and II) for each grade and specialty. Specialist registrars in both specialties intubated the majority of patients, including 62.6% in the EM group and 47.0% in the anesthesia group. Figure 1 shows the Cormack–Lehane grade of laryngoscopy at the first intubation attempt for anesthetists and EPs.

Consultants obtained good views on the initial intubation attempt in 91.2% of patients, and specialist registrars obtained good views in 92.2% of patients (p = NS). There was a trend for increasing proportions of good views in the EP group because physician seniority increased.

EPs used stylets in 193/369 of RSI attempts (52.3%; 95% CI, 47.1%–57.5%), and anesthetists used them in 73/338 attempts (21.6%; 95% CI, 17.3%–26.4%). In contrast, EPs used a gum-elastic bougie in 23/369 attempts (6.2%; 95% CI, 4.0%–9.2%), and anesthetists used them in 37/339 attempts (10.9%; 95% CI, 7.8%–14.7%). Overall, EPs used one of these adjuncts to assist intubation in

Table 1. Baseline characteristics for the two study groups

Characteristic	EM group (n = 376)	Anesthesia group (n = 355)
Intubating physician		
Median age, in years	49	44
Male gender, no. (and %)	246 (65.4)	260 (73.2)
Patient		
Trauma victim, no. (and %)	140 (37.2)	172 (48.5)
Head injury, no. (and %)	130 (34.7)	149 (42.0)
Presented during office hours*	25.3% (94/371)†	25.3% (87/344)†

EM = emergency medicine
*Office hours = 0900–1700, Monday to Friday.
†Missing data for some patients.

https://doi.org/10.1017/S1481803500009416 Published online by Cambridge University Press

216/369 cases (58.5%; 95% CI, 53.3%–63.6%), and anesthetists did so in 110/339 cases (32.4%; 95% CI, 27.5%–37.7%).

There was an increasing rate of failed intubation attempts when poor views were obtained on first laryngoscopy: multiple intubation attempts were necessary in 34/57 cases (59.6%; 95% CI 45.8%–72.4%) when poor views were obtained, but in only 45/615 cases (7.3%; 95% CI, 5.4%–9.7%) when good views were obtained.

Discussion

Most intubation attempts, regardless of the physician's specialty, were associated with Cormack–Lehane grades I or II laryngoscopy. Trainee anesthetists, including specialist registrars and senior house officers, obtained better laryngoscopic views than EM trainees of comparable grade. This was true for trauma patients and head-injured patients, where differences were statistically significant. There was, however, no significant difference in complication rate.[6]

Previous studies have suggested that there is a significant learning curve related to endotracheal intubation and that intubators require between 47 and 57 intubations before they achieve a 90% success rate.[7,8] However, these studies considered only elective intubations by novice intubators and did not assess laryngoscopic views or intubation in the challenging ED environment.

Our data show that in the EM group the likelihood of good views increases with seniority. This suggests that experience and training are of critical importance and that these may differ for EM and anesthesia trainees. It also suggests the need for further prospective study of education in laryngoscopic technique for EM trainees. It is pos-

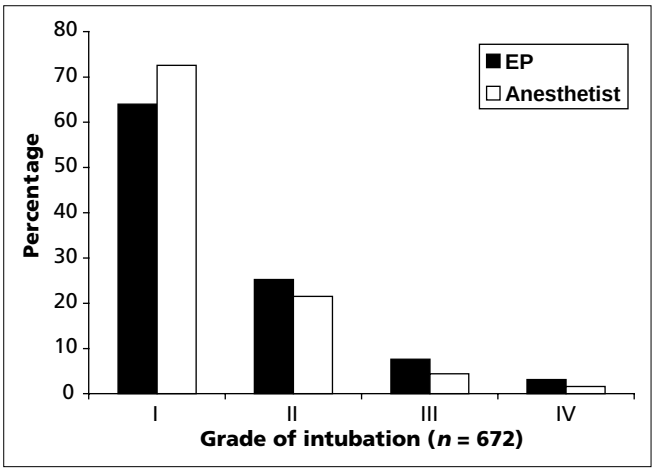

Fig. 1. Cormack–Lehane grade view obtained at first intubation attempt, by specialty.

Table 2. Summary of laryngoscopic "good view" outcomes (Cormack–Lehane grade I or II) by specialty and patient subgroup

	Emergency medicine		Anesthesia		
Patient subgroup	No. (and %)	95% CI	No. (and %)	95% CI	*p* value
Trauma	114/130 (87.7)	80.8–92.8	142/150 (94.7)	89.8–97.7	0.038
Non trauma	201/223 (90.1)	85.4–93.7	156/167 (93.4)	88.5–96.4	0.25
Head injury	107/122 (87.7)	80.5–93.0	124/130 (95.4)	90.2–98.3	0.027
Treated during office hours*	79/87 (90.8)	82.7–96.0	80/83 (96.4)	89.8–99.2	0.14
Treated out of office hours	232/262 (88.6)	84.1–92.1	207/223 (92.8)	88.6–95.8	0.11

EP = emergency physicians; CI = confidence interval
*Office hours = 0900–1700, Monday to Friday.

Table 3. Proportion of "good view" outcomes (Cormack–Lehane grade I or II) by specialty and physician grade

	Emergency medicine		Anesthesia		
Physician grade*	No. (and %)	95% CI	No. (and %)	95% CI	*p* value
Consultant	64/69 (92.8)	83.9–97.6	19/22 (86.4)	65.1–97.1	0.36
Specialist registrar	191/213 (89.7)	84.8–93.4	138/144 (95.8)	91.2–98.5	0.034
Senior house officer	58/69 (84.1)	73.3–91.8	126/135 (93.3)	87.7–96.9	0.035
Staff grade		0	12/13 (92.3)	64.0–99.8	

CI = confidence interval; *p* = z test for two proportions.
*See Methods section for definitions of physicians in the United Kingdom.

https://doi.org/10.1017/S1481803500009416 Published online by Cambridge University Press

sible that EM trainees may benefit from additional focus on laryngoscopic visualization techniques early in their training period.

The observed reduction in the proportion of good views in the consultant anesthetist group may reflect the possibility that consultant anesthetists are often called to assist when a particularly difficult intubation is anticipated, and they may often elect to perform the intubation in those circumstances rather than supervise.

In our setting, anesthetists were more likely to use a gum-elastic bougie than a stylet as an adjunct for difficult intubations, and this was associated with higher rates of successful intubation. Further training in the use of this technique by EPs may improve their success rate for intubation when laryngoscopy reveals poor views, but this hypothesis needs to be prospectively tested.

Anesthetists may have increased familiarity with the Cormack–Lehane classification as well as more experience of airway management. Despite this, there remains marked variation between studies (as well as between anesthetists) with regard to documentation of grade of laryngoscopy.[9] Laryngoscopic view depends on multiple factors, such as head position, degree of muscle relaxation, skill of assistant at providing cricoid pressure and type and/or size of laryngoscope blade.[9] It is possible that some doctors are unaware of the manoeuvres that may easily be performed to improve laryngoscopic view — such as the BURP (backward upward rightward pressure) manoeuvre.[10]

Limitations

Inter-observer reliability of the Cormack–Lehane grading system[4] may be limited, and some of the difference seen might be related to different reporting by EPs and anesthetists. A possible alternative for future studies is the POGO (percentage of glottic opening) scale, which has been reported to have good inter-physician and intra-physician reliabilities.[11]

Conclusions

Anesthesia trainees tend to obtain better laryngoscopic views than EM trainees, but these differences disappear with increasing EP seniority, suggesting a training and experience effect. EM trainees may benefit from additional focus on laryngoscopic visualization techniques early in their training period.

Competing interests: None declared.

Acknowledgements: We thank the medical and nursing staff in the participating departments for their assistance in data collection. We also extend our appreciation to all the staff at the Scottish Trauma Audit Group.

Funding: We thank the Scottish Trauma Audit Group for funding, project coordination and data collection, entry and analysis. We thank the Medic 1 Trust Fund for assistance with printing data collection forms.

References

1. Walls RM. Rapid-sequence intubation comes of age. Ann Emerg Med 1996;28:79-81.
2. Walker A, Brenchley J. Survey of the use of rapid sequence induction in the accident and emergency department. J Accid Emerg Med 2000;17:95-7.
3. McBrien ME, Pollok AJ, Steedman DJ. Advanced airway control in trauma resuscitation. Arch Emerg Med 1992;9:177-80.
4. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984;39:1105-11.
5. Orebaugh SL. Difficult airway management in the emergency department. J Emerg Med 2002;22:31-48.
6. Graham CA, Beard D, Oglesby AJ, Thakore SB, Beale JP, Brittliff J, et al. Rapid sequence intubation in Scottish urban emergency departments. Emerg Med J 2003;20:3-5.
7. Mulcaster JT, Mills J, Hung OR, MacQuarrie K, Law JA, Pytka S, et al. Laryngoscopic intubation: learning and performance. Anesthesiology 2003;98:23-7.
8. Konrad C, Schüpfer G, Wietlisbach M, Gerber H. Learning manual skills in anesthesiology: Is there a recommended number of cases for anesthetic procedures? Anesth Analg 1998;86:635-9.
9. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting the difficult intubation. Br J Anaesth 1998;61:211-6.
10. Takahata O, Kubota M, Mamiya K, Akama Y, Nozaka T, Matsumoto H, et al. The efficacy of the "BURP" maneuver during a difficult laryngoscopy. Anesth Analg 1997;84:419-21.
11. Levitan RM, Ochroch EA, Kush S, Shofer FS, Hollander JE. Assessment of airway visualization: validation of the percentage of glottic opening (POGO) scale. Acad Emerg Med 1998;5:919-23.

Correspondence to: Dr. Colin A. Graham, Associate Professor, Accident & Emergency Medicine Academic Unit, Chinese University of Hong Kong, Trauma & Emergency Centre, Prince of Wales Hospital, Shatin, New Territories, Hong Kong SAR. +852 2632 1033, fax +852 2648 1469, cagraham@cuhk.edu.hk