Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

POGO score for TV was 100% ($P<.001$). The median difference in POGO scores (TV and DL) was as follows: 50% for PGY-1 residents, 50% for PGY-2 residents, and 25% for PGY-3 residents. As for ease of use, 85.7% (24) reported that the TV was "easy" to use, 10.7% (3) were undecided, and 3.6% (1) reported that the TV was "difficult" to use, whereas 82.1% (23) reported that the TV improved their intubation attempt, 14.3% (4) reported no difference, and 3.6% (1) reported that the TV made the intubation attempt more difficult. In phase 2, there were 37 participants. Overall, the median TV and DL POGO scores were 75% and 25%, respectively ($P=.004$). The median difference in POGO scores (TV and DL) for the 2 groups was as follows: 75% for group 1 and 50% for group 2. Of all the participants, 67.6% (25) ranked the TV as "easy" to use, 21.6% (8) were undecided, and 10.8% (4) ranked the TV as "difficult" to use, whereas 56.8% percent (21) reported that the TV improved their intubation attempts, 27% (10) reported no difference, and 10.8% (4) reported that the TV made the intubation attempts more difficult.

Conclusion: The Trachview Videoscope is easy to use and improves the POGO score and subjective evaluation of performance for intubation by individuals with various experience levels.

379 The Effect of Paramedic Rapid Sequence Intubation on Outcome in Trauma Patients

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Study objectives: The objective of this study is to evaluate the effect of paramedic rapid sequence intubation (RSI) on trauma patient outcome.

Methods: Consecutive major trauma patients were prospectively enrolled in 2 phases, the first before and the second after the implementation of a paramedic RSI program. Paramedics with experience in this mixed suburban and rural emergency medical services (EMS) system were eligible for RSI training. RSI training consisted of 6 hours of didactic and mannequin training. Operating room intubation experience is required for oral intubation clearance in the system but is not used for RSI training. All trauma patients with a Glasgow Coma Scale (GCS) score between 3 and 8 and for whom resuscitation was indicated were eligible for inclusion. Exclusion criteria included death in the field or ED and inability to obtain outcome information. For both phases, intubation was indicated for trauma patients with a GCS score of 3 to 8. For phase 2, oral intubation was attempted for all patients before RSI. Etomidate and succinylcholine were administered for RSI. RSI was not attempted for patients for whom the alternative airways, esophageal-tracheal twin-lumen airway device (Combitube), cricothyrotomy, or bag-valve-mask ventilation was judged not feasible. The Combitube was used as the primary salvage airway device. Method of airway control, intubation success rates, and survival to hospital discharge were determined.

Results: There were 134 patients with outcomes in phase 1: 19 of 21 (90.5%) in arrest at presentation had a definitive airway established, and 19 had additional exclusion criteria, leaving 94 for analysis. There were 386 patients with outcomes in phase 2: 85 of 94 (90.4%) in arrest at presentation had a definitive airway established, and 65 had additional exclusion criteria, leaving 227 for analysis. The oral intubation success rate was improved for phase 2 study versus phase 1 control patients (53.3% versus 14.9%); total definitive airway rate was also greater (59.5% versus 40.4%). RSI was used in 112 patients; 11 were excluded. Oral intubation success for RSI patients was 87.5%; 91.1% had definitive airways established. Survival for patients with oral intubation without RSI was similar for both phases (42.4% versus 42.9%). Survival for study patients was improved during phase 2 (78.0% versus 67.3%). Survival for study RSI patients was 85.1%.

Conclusion: EMS protocols for paramedic RSI resulted in improved intubation success rates and improved survival to hospital discharge.

380 The Effect of Severe Acute Respiratory Syndrome on Emergency Airway Management

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Study objectives: From early March 2003 to late May 2003, severe acute respiratory syndrome (SARS) was detected in Singapore. Two hundred thirty-eight patients were infected; 33 died. Forty-two percent were health care workers. The whole medical system in the country was put under stress. One major public hospital became the designated SARS hospital. Emergency cases were diverted to the remaining public hospitals, of which Singapore General Hospital was the main recipient. The increase in workload, new infection control procedures including mandatory wearing of the positive airway pressure respirator and personal protective equipment (PPE), and limiting the number of person-contacts with each patient were thought to affect resuscitation and airway management. Our aim is to study the effects of wearing of PPE and the restriction in number of resuscitation personnel on airway management during the SARS crisis.

Methods: The emergency department has an ongoing airway registry that prospectively captures patient demographics, diagnosis, indications for intubation, persons and discipline of intubating physician, number of attempts, method of intubation, success rates, and complications. The data were divided into 3 periods: (1) before PPE was instituted from November 1, 2002, to March 31, 2003; (2) during SARS (when PPE use was mandatory) from April 1 to July 31, 2003; and (3) after SARs (when PPE use was nonmandatory but encouraged) from August 1 to December 31, 2003.

Results: There was no change in patient demographics during the 3 periods, but there was a change in the patient diagnoses in period 2, with decreases in the proportion of respiratory and cardiac cases and increases in neurology and trauma cases. These changes reverted to the previous distribution in period 3. The alarming discovery was that whereas in period 1 (pre-SARS), resident medical officers attempted intubations 45% of the time, this figure went down to 35% in period 2 (SARS) and 23% in period 3 (post-SARS). Anesthetists performed 1.2%, 8%, and 0% of emergency intubations in periods 1, 2, and 3, respectively. Attending emergency physicians performed 54%, 56%, and 77% of intubations in periods 1, 2, and 3, respectively. The complication/peri-intubation event rates were 10.5%, 9.9%, and 9.4% in periods 1, 2, and 3, respectively. The success rate for residents was 80.8%, 89%, and 86.2% in periods 1, 2, and 3, respectively.

Conclusion: The wearing of PPE and positive airway pressure respirator is thought to make intubation more difficult, as seen by the increase in proportion of intubations performed by anesthetists in period 2 and by attending emergency physicians in periods 2 and 3. The infection control policy that restricts the number of health care staff attending to each patient may have influenced the department's decision to allow only the most confident or experienced personnel to manage the airway. The exposure of junior residents in emergency airway management during SARS and the immediate post-SARS period was decreased. This trend should be further monitored, and intervention may be necessary should it continue to decline.

381 Emergency Physicians Cannot Inflate or Estimate Endotracheal Tube Cuff Pressure Using Standard Techniques

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Study objectives: Tracheal necrosis and stenosis may result from an overinflated endotracheal tube cuff. Safe, appropriate pressure in endotracheal tube cuffs is considered to be between 15 and 25 cm H_2O, pressures below normal capillary perfusion pressure. We seek to determine the ability of emergency medicine residents and attending physicians in accredited emergency medicine residency training programs to inflate an endotracheal tube cuff to appropriate pressure using standard syringe technique and assess appropriateness of pressure of previously inflated endotracheal tube cuffs by palpating the pilot balloon.

Methods: This institutional review board–approved descriptive survey of resident and attending physicians in accredited emergency medicine residency training programs in New York City used a previously tested, tracheal simulation model with a 7.5-mm endotracheal tube with a high-volume low-pressure cuff (Mallinkrodt, St. Louis, MO). Using their choice of a 5-mL or 10-mL plastic syringe with standard Luer Lock (Beckton-Dickson, Franklin Lakes, NJ), participants inflated the endotracheal tube cuff by standard method of injecting air as they deemed appropriate in conjunction with palpating the pilot balloon to estimate cuff pressure. Subsequently, the endotracheal tube cuff pressure was measured using a highly sensitive and accurate analog manometer (Boehringer Laboratories, Norristown, PA). Later, participants palpated the pilot balloon of 9 endotracheal tubes with cuffs previously inflated to known pressures ranging from 0 to 120 cm H_2O and reported whether the pressure was low, appropriate, or high.

Results: Twenty-five resident physicians and 42 attending physicians from 5 emergency medicine residency training programs were surveyed. Only 0.4% (n=3) of participants inflated the cuff to a safe pressure; all were attending physicians. The average cuff pressure generated by emergency medicine attending physicians was greater than 98 cm H_2O (attending physicians >93 cm H_2O, residents >106 cm H_2O). The true mean could not be determined because 57% (n=38) inflated to pressures greater than the upper limit of manometer sensitivity (>120 cm H_2O). Using palpation, participants were only 33% sensitive detecting inappropriately inflated endotracheal tube cuffs (attending physicians 22% sensitive, residents 53% sensitive), and they were only 26% sensitive in detecting overinflated endotracheal tube cuffs (attending physicians 22%, residents 33%). Average experience as an attending emergency physician was 9 years; average experience as a resident was 2.1 years.

Conclusion: This group of emergency physicians had little ability to inflate an endotracheal tube cuff to safe pressure, little ability to accurately estimate pressure of a previously inflated cuff using standard technique, and minimal ability to detect overinflated endotracheal tube cuffs. Nearly all inflated the cuff to dangerously high pressures. Clinicians should consider using devices that permit safe and accurate inflation and measurement of endotracheal tube cuff pressure rather than relying on standard palpation technique, which is potentially unsafe and highly inaccurate.

382 Assessment of a New Method to Distinguish Esophageal From Tracheal Intubation by Measuring the Endotracheal Cuff Pressure in a Porcine Model

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Study objectives: Timely assessment of proper endotracheal tube placement is necessary to avoid serious morbidity and mortality. Various methods are used to verify tracheal intubation and to detect esophageal intubation. Many of these methods fail under certain circumstances. With the knowledge of differences of anatomic structure and resistance against certain volume between trachea and esophagus, we conduct an animal study to evaluate the usefulness of the endotracheal cuff pressures in endotracheal and esophageal intubation to detect esophageal intubation.

Methods: Six swine were anesthetized and intubated with regular 7.5-mm endotracheal tube (Mallincrodt Medical Intermediate Hi-Lo). After confirmation of tracheal intubation by fiberoptic bronchoscopy, a second endotracheal tube (also 7.5 mm) was placed in the esophagus of each swine, and the cuffs were not inflated. Both tubes extended the same distance from the mouth. Each pilot balloon of both tubes was connected to a 10-mL syringe and a manometer by a 3-way stopcock. The cuff pressure was measured after incremental 1-mL filling volume of air. The data of cuff pressure caused by variable volume in both endotracheal and esophageal intubations were compared. The pressure-volume relationships in both intubations were also measured.

Results: The endotracheal cuff pressures (mean±SD) increased significantly in esophageal intubations compared with endotracheal intubation (115±12.4 versus 53±9.8 cm H_2O, at 10-mL inflation of air, $P<.05$). The pressure and the rate of increase in cuff pressure were also significantly higher ($P<.05$) in the esophageal intubation during the inflation of the cuff in the study.

Conclusion: In this animal study, the cuff pressure of esophageal intubation was significantly higher than that of endotracheal intubation under the same inflated volume. It may provide an adjunctive, simple, rapid, and reliable method to verify endotracheal intubation and detect the occurrence of esophageal intubation by measuring the endotracheal cuff pressure.

383 The Glidescope Video Laryngoscope in the Hands of Novice Users: Seeing the Larynx Does Not Correlate With Intubation Success

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Study objectives: Rescue intubation devices should be easy to use. The Glidescope Video Laryngoscope (GVL) uses a miniature video camera built within a curved laryngoscope. The camera position and wide field of view create laryngeal visualization by a monitor in almost any patient. Because of its traditional laryngoscope shape and method of insertion, the GVL should be easy to use, with fast initial skill acquisition. The objective of this study is to assess the intubation performance of novice users of the GVL.

Methods: Sixteen participants (11 emergency physicians, 4 residents, 1 physician's assistant) used the GVL on 3 randomly ordered, nonembalmed cadavers. All were easy laryngoscopies with standard equipment. Participants observed 1 demonstration of the GVL and were told to shape the tube stylet as recommended by the manufacturer. Each attempt was recorded and timed using a digital VCR connected to the GVL monitor. Success was defined as tracheal intubation; failure was defined by the inability to intubate the trachea.

Results: Laryngeal view was excellent in all 48 intubation attempts (percentage of glottic opening scores >90%). Overall, 36 (75%) of 48 attempts succeeded, with a mean intubation time of 76 seconds (95% confidence interval [CI] 58 to 94 seconds). Seven of 36 successful intubations occurred in 30 seconds or less. Nine of 16 participants succeeded on 3 of 3 cadavers; 1 failed on 3 of 3. Success by cadaver varied from 15 of 16 to 10 of 16, with mean success times per cadaver from 48 seconds (95% CI 31 to 65 seconds) to 108 seconds (95% CI 73 to 143 seconds). Performance was dependent on the specific cadaver and not related to the order of attempts: first cadaver attempt success rate was 13 of 16 (mean time 86±31 seconds) versus third cadaver success rate of 10 of 16 (mean time 74±38 seconds).

Conclusion: In this study, novices obtained excellent laryngeal views with the GVL but tracheal tube placement—through a monitor and procedurally similar to laparoscopic surgery—was awkward, slow, and often unsuccessful. GVL difficulty varied considerably between cadavers. Three attempts did not produce competency in our study.

384 Location of the Endotracheal Tube by Pilot Balloon-Cuff Counter-Ballottement

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Study objectives: Mastery of the airway is the primary skill of an emergency physician. A wide variety of techniques and devices have been designed to help obtain and control a patent airway during an emergency airway crisis. Presently, the criterion standard for clinical assessment of proper endotracheal tube verification in the airway is a change in the color indicator on the end-tidal carbon dioxide detector device, augmented by another method such as endotracheal tube aspiration. However, depth of insertion of the endotracheal tube or location within the trachea is usually determined clinically by symmetry of auscultated bilateral breath sounds or subsequently confirmed by postintubation chest radiograph. Earlier work in other clinical settings has demonstrated that with pilot balloon-cuff counter-ballottement (PBCCB) technique, the endotracheal tube cuff can be located externally by gentle palpation at the patient's suprasternal notch, with simultaneous counter-ballottement palpation of the endotracheal tube pilot balloon, using the pilot balloon as a cuff sensor. Palpation and compression of the inflated endotracheal tube cuff distends the pilot balloon accordingly. The purpose of this study is twofold: (1) to obtain a retrospective derivation set of patients, in which the endotracheal tube was repositioned postintubation, representing the rate of endotracheal tube malposition (ie, "usual care"); and (2) to obtain a prospective validation set after a training intervention to determine whether PBCCB provides an additional clinical tool for the emergency physician, thereby reducing the need for endotracheal tube repositioning by postintubation chest radiograph.

Methods: In a random, retrospective, convenience sample, we examined 221 radiographs or radiography reports from 419 adult emergency department patients who underwent rapid sequence intubation (RSI) from July 1, 2001, through June 30, 2002. Endotracheal tube position (ie, depth of the endotracheal tube within the trachea above the carina) was quantified. The incidence of postintubation repositioning of the endotracheal tube after chest radiograph comprised the incidence of repositioning or "usual care." Next, emergency physicians received standardized group and individualized training in the application of PBCCB technique. In a subsequent random, prospective, convenience sample during 4 consecutive months, emergency physicians were asked to complete a postintubation procedure card, before the chest radiograph was reviewed, indicating whether the externally palpated endotracheal tube cuff by PBCCB technique was at (preferred), above (acceptable), or below (possibly requiring repositioning) the patient's suprasternal notch. These results were compared with those noted from the postintubation chest radiograph.