## AIRWAY SYSTEMATIC REVIEWS

### A SUMMARY OF THE MAJOR TOPICS 2009-2018

**Title** | **Journal** | **PMID** | **Authors** | **Abstract**
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Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review. | For Arch Otolaryng | 26259570 | Aldy A 2018 Mar | The objective of this article is to evaluate the appropriate timing of tracheostomy in patients with prolonged intubationregarding the incidence of hospital-acquired pneumonia, mortality, length of stay in intensive care unit (ICU) and duration of artificial ventilation. There was a significant difference in favor of early tracheostomy in adults' three groups and pediatric age group as early tracheostomy was superior regarding reduced duration of mechanical ventilation, with less mortality rates and less duration of stay in ICU. Regarding hospital-acquired pneumonia, it was significantly less in adults group compared to pediatric age group (3 patients out of 72 pediatric patient with early tracheostomy had pneumonia compared to 11 patients out of 68 with late tracheostomy). Studies defining early tracheostomy as that done within 7 days of intubation had better results than those defining early tracheostomy as that done within 14 or 21 days of intubation. In conclusion, early tracheostomy within 7 days of intubation should be done for both adults and pediatric patients with prolonged intubation.**

Tracheal intubation in critically ill patients: a comprehensive systematic review of randomized trials. | Crit Care | 26351759 | Catalini L 2018 Jan 20 | RESULTS: We identified 22 trials on use of a pre-procedure check-list (1 study), pre-oxygenation or apneic oxygenation (6 studies), sedatives (3 studies), neuromuscular blocking agents (1 study), patient positioning (1 study), video laryngoscopy (9 studies), and post-intubation lung recruitment (1 study). Pre-oxygenation with non-invasive ventilation (NIV) and/or high-flow nasal cannula (HFNC) showed a possible beneficial role. Post-intubation recruitment improved oxygenation, while ramped position increased the number of intubation attempts and intubation time. High-flow nasal cannula is an independent risk factor for difficult and failed tracheal intubation. However, no systematic review of randomized trials has evaluated conditions for tracheal intubation, possible adverse effects, and postoperative discomfort. **CONCLUSIONS:** This review supports that use of an NMBAs may create the best conditions for tracheal intubation and may reduce the risk of upper airway discomfort or risk of failure in randomized trials.**

Video Laryngoscopy for Endotracheal Intubation of Critically Ill Adults: A Systematic Review and Meta-Analysis. | Chest | 28029915 | Huang HS 2017 Sep | RESULTS: Five randomized controlled trials with 1,301 patients were included. **CONCLUSIONS:** The VL technique did not increase the first-attempt success rate during EI in ICU patients compared with DL. These findings do not support routine use of VL in ICU patients.**

Avoidance versus use of neuromuscular blocking agents for improving tracheal intubation or direct laryngoscopy in adults and adolescents. | Cochrane Database Syst Rev | 28513831 | Lundstrøm LH 2017 May 17 | BACKGROUND: Tracheal intubation during induction of general anaesthesia is a vital procedure performed to secure a patient’s airway. Several studies have identified difficult tracheal intubation (DTI) or failed tracheal intubation as one of the major contributors to anaesthesia-related mortality and morbidity. Use of neuromuscular blocking agents (NMBAs) to facilitate tracheal intubation is a widely accepted practice because of adverse effects. NMBA may be underutilized in some centres, and avoiding NMBA is independent risk factor for difficult and failed tracheal intubation. However, no systematic review of randomized trials has evaluated conditions for tracheal intubation, possible adverse effects, and postoperative discomfort. **AUTHORS’ CONCLUSIONS:** This review supports that the use of an NMBAs may create the best conditions for tracheal intubation and may reduce the risk of upper airway discomfort or risk of failure in randomized trials.**

Can High-flow Nasal Cannula Reduce the Rate of Endotracheal Intubation in Adult Patients With Acute Respiratory Failure? | Chest | 28088616 | Ni YN 2017 Apr | BACKGROUND: The effects of high-flow nasal cannula (HFNC) on adult patients with acute respiratory failure (ARF) are controversial. We aim to further determine the effectiveness of HFNC in reducing the rate of endotracheal intubation in adult patients with ARF by comparison to noninvasive positive pressure ventilation (NIPPV) and conventional oxygen therapy (COT). **RESULTS:** Eighteen trials with a total of 3,891 patients were included in our meta-analysis. HFNC did not exhibit any advantage over either COT or NIPPV. **CONCLUSIONS:** In patients with ARF, HFNC is a more reliable alternative than NIPPV to reduce the rate of endotracheal intubation than COT.

Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. | Cochrane Database Syst Rev | 27844477 | Lewis SR 2016 Nov 15 | AUTHORS’ CONCLUSIONS: Videolaryngoscopy may reduce the number of failed intubations, particularly among patients presenting with a difficult airway. They improve the glottic view and may reduce laryngeal/airway trauma. Currently, no evidence indicates that use of a VLS reduces the number of intubation attempts or the incidence of hypoxia or respiratory complications, and no evidence indicates that use of a VLS affects time required for intubation.**

A Retrospective Study of Success, Failure, and Time Needed to Perform Awake Intubation | Anesthesiology | 27111535 | Joseph H T 2016 Jul | RESULTS: The median time to intubation for patients intubated post induction was 16.0 min (interquartile range: 13 to 22) from entrance to the operating room. The median time to intubation for awake patients was 24.0 min (interquartile range: 19 to 31). The complication rate was 0% (6/268 patients). The most frequent complication observed was mucous plug, endotracheal tube cuff leak, and inadvertent extubation. The failure rate for attempted awake intubation was 1% (n = 10). **CONCLUSIONS:** Awake intubations have a high rate of success and low rate of serious complications and failure. Awake intubations can be performed safely and rapidly.

Prophylactic Administration of Corticosteroids for Preventing Postoperative Complications Related to Tracheal Intubation: A Systematic Review and Meta-Analysis of 18 Randomized Controlled Trials. | Clin Drug Investig | 26715108 | Zhang W 2016 Apr | RESULTS: Eighteen RCTs with a total of 2,685 patients were included in this meta-analysis. Pooled estimates showed that corticosteroids significantly reduced the incidence of postoperative sore throat, hoarseness, and cough. Moreover, corticosteroids had a positive effect on the incidence of laryngeal edema and reintubation. Subgroup analysis showed that corticosteroids significantly increased the incidence of severe throat pain and hoarseness, but not cough. **CONCLUSIONS:** Evidence from this meta-analysis of 18 RCTs indicated that prophylactic administration of corticosteroids is not only effective in reducing the incidence and severity of postoperative sore throat and hoarseness, but also the incidence of laryngeal edema and reintubation.

Experience in Prehospital Endotracheal Intubation Significantly Influences Mortality of Patients with Severe Traumatic Brain Injury: A Systematic Review and Meta-Analysis. | Plast Reconstr Surg | 26486440 | Botter s BM 2015 | The search provided 733 studies, of which 8 studies including data from 4772 patients met inclusion and quality criteria for the meta-analysis. Prehospital intubation by providers with limited experience was associated with an approximately 10-fold increase in the odds of death at 6 months (OR 33.95% CI 23.93 to 43.98, p < 0.001). In contrast, there was no evidence for higher mortality in patients who were intubated by providers with extended level of training (OR 0.75, 95% CI 0.52 to 1.08, p = 0.126). Meta-regression confirmed that experience is a significant predictor of mortality (p = 0.009). **CONCLUSIONS:** Effects of prehospital endotracheal intubation depend on the prehospital system’s healthcare providers. Intubation by providers with limited experience increases mortality, suggesting that routine prehospital intubation of TBI patients should be abandoned in emergency medical services in which providers do not have ample training, skill and experience in performing this intervention.

Multiple failed intubation attempts are associated with decreased success rates in the first rescue intubation in the emergency department | J Trauma Acute Care Surg | 25700237 | Gotto T 2015 Jan 16 | BACKGROUND: Although the international guidelines emphasize early and systematic use of rescue intubation techniques, there is little evidence to support this notion. We aimed to test the hypothesis that preceding multiple failed intubation attempts are associated with a decreased success rate on the first rescue intubation in emergency departments (EDs). **RESULTS:** Of 6,273 consecutive patients, 1,151 underwent a rescue intubation. **CONCLUSIONS:** Preceding multiple failed intubation attempts was independently associated with a decreased success rate on the first rescue intubation in the ED.

BET 2: transtracheal ultrasound to confirm tracheal intubation in Adult in cardiopulmonary arrest. | Emerg Med 2014 Dec 4 | Lelain I E fourier 2014 Dec | A short-cut review was carried out to establish whether transtracheal ultrasonography can reliably identify tracheal placement of and endotracheal tube during cardiac arrest. Using the reported searches, 260 papers were found of which one presented the best evidence to confirm tracheal intubation in adult in cardiopulmonary arrest. The author, date and content of publication, result outcomes, results and study weaknesses of this best paper are tabulated. It is concluded that transtracheal ultrasonography may be a supplementary tool for the correct tracheal tube placement in cardiac arrest. Further work is needed.

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Can non-invasive positive pressure ventilation prevent endotracheal intubation in acute lung injury/acute respiratory distress syndrome? A meta-analysis.

Pentax Airway Scope(R) vs Macintosh laryngoscope for tracheal intubation in adult patients: a systematic review and meta-analysis.

Video laryngoscopy versus direct laryngoscopy for orotracheal intubation in the intensive care unit: a systematic review and meta-analysis.

BET 3: is rocuronium as effective as succinylcholine at facilitating laryngoscopy during rapid sequence intubation?

Comparison of video laryngoscopes with direct laryngoscopy for tracheal intubation: a meta-analysis of randomised trials.

The association between obesity and difficult prehospital tracheal intubation.

Revisiting the value of pre-hospital tracheal intubation: an all time systematic literature review extracting the Utstein airway core variables.

Sugammadex for reversal of rocuronium block after rapid sequence intubation: a systematic review and economic assessment.

Controversies surrounding the use of etomidate for rapid sequence intubation in patients with suspected sepsis.


Avoidance of neuromuscular blocking agents may increase the risk of difficult tracheal intubation: a cohort study of 103,812 consecutive adult patients recorded in the Danish Anaesthesia Database.

Results:
The meta-analysis included six RCT involving 227 patients. The results showed that endotracheal intubation rate was lower in NIPPV (95% confidence interval (CI): 0.44-0.86; z = 3.44, P = 0.0006), but no significant difference was found either in intensive care unit (ICU) mortality (95% CI: 0.45-1.07; z = 1.65, P = 0.10) or in hospital mortality (95% CI: 0.17-1.52; z = 1.16, P = 0.23). Only two studies discussed the use of ALARMS as pulmonary or extra-pulmonary, and neither showed statistical heterogeneity (I² = 0%, Q(2) = 0.31; P = 0.58), nor a significant difference in endotracheal intubation rate (95% CI: 0.50-0.78; z = 0.39, P = 0.49). In conclusion, the early use of NIPPV may decrease the endotracheal intubation rate in patients with ALARMS, but does not change the mortality of these patients.

We included 17 randomised controlled trials with a total of 1801 patients. We used the DerSimonian and Laird random-effects model to calculate pooled relative risk or weighted mean differences. The relative risk (95% CI) of a Cormack-Lehane grade I laryngeal view was 2.40 (1.78-2.94) with the Pentax Airway Scope compared with the Macintosh laryngoscope, p < 0.0001. We found no other differences between the two laryngoscopes. Despite a superior laryngeal view, the Pentax Airway Scope provides little clinical benefit over the conventional laryngoscope.

RESULTS: Nine trials with a total of 2,133 participants (1,067 in DL and 1,066 in VL) were included in the current analysis. Compared to DL, VL reduced the risk of difficult DTI [OR 0.29 (95% confidence interval (CI) 0.20-0.44; p < 0.001)]. Cormack 3/4 grades [OR 0.26 (95% CI 0.14-0.48)] and grade V [OR 0.02 (95% CI 0.00-0.25)] were less frequent with VL compared to DL. For successful [OR 0.27 (95% CI 1.35-3.16; p < 0.001)] and failed intubations [OR 0.27 (95% CI 0.14-0.48)] no significant difference was found for severe hypoxemia, severe cardiovascular collapse or airway injury. CONCLUSIONS: These results suggest that VL could be useful in airway management in ICU patients.

A short-cut review was carried out to establish whether rocuronium is as effective as succinylcholine at facilitating laryngoscopy during rapid sequence intubation. A total of six RCTs were used in the analysis of which seven represented physically derived evidence to answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of these best papers are tabulated. The clinical bottom line is that rocuronium is as effective as succinylcholine at facilitating laryngoscopy during RSI.

RESULTS: Eleven trials with a total of 11,966 participants were identified. During tracheal intubation, video laryngoscopes can achieve a better view of the glottis and have a similar success rate [rate ratio 1.0; 95% confidence interval (CI) 0.99-1.01]. Overall, the time to tracheal intubation was not different between the video laryngoscopes and direct laryngoscopy (standardised mean difference 0.19; 95% CI: 0.07-0.31). However, in a subgroup analysis, video laryngoscopes shortened the time taken for difficult intubation (standardised mean difference, -0.75; 95% CI -1.24 to -0.25). CONCLUSIONS: Video laryngoscopes are a good alternative to direct laryngoscopy during tracheal intubation. The advantage seems to be more prominent when difficult intubation is encountered.

RESULTS: Of 80,501 patient contacts in whom 4141 Ts were attempted during the 4-year study period, 823 met study entry criteria (including a calculable BMI). The overall TI success rate in the study population was 98.5% (811 out of 823), with 8.6% (56 out of 823) meeting the predetermined definition for difficult TI. There was no significant association between difficult TI and patient age, gender, use of succinylcholine, or medical diagnosis (trauma vs. non-trauma). In comparison with the lean patient subgroup (BMI <30 kg/m2), patients with class III obesity (BMI >40 kg/m2) had a significant association with difficult TI (odds ratio 3.68; confidence interval [CI] 1.03-11.93) whereas those with class III obesity (BMI >30 kg/m2) did not (odds ratio 0.38; confidence interval [CI] 0.08-1.66). CONCLUSIONS: Among prehospital ALS providers with previously documented and published successful TI performance, increased difficulty with TI was observed in patients with extreme obesity, but not in patients with lesser degrees of obesity. Because extreme obesity is an easily identifiable patient characteristic, didactic and clinical (e.g., operating room) airway management education for such providers should emphasize the association with obesity, including specific equipment, patient positioning, and practice recommendations that may facilitate both TI and alternative airway management techniques in this population.

RESULTS: From 1,076 identified records, 73 original papers were selected. Information was extracted according to an Utstein template for data reporting from in-the-field advanced airway management. Fifty-nine studies were from North American EMS systems. Of these, 49 (83%) reported on 12,799 intubations (9,186) of which non-physicians conducted 3,568 (39%) TI. In 12 of the 49 TI attempts performed by non-physicians, the best evidence was published. The overall, two were randomised controlled trials (RCTs), and 65 were observational studies. None of the studies presented the complete set of recommended Utstein airway variables. The median number of core variables reported was 10 (interquartile range, 2), and the median number of fixed system variables was 5 (max, 11, min, 0). IQR 4-8. Among the most frequently reported variables were patients' category' and 'service mission type', reported in 86% and 71% of the studies, respectively. Among the least-reported variables were 'co-morbidity' and 'type of available ventilator', both reported in 2% and 1% of the studies, respectively. CONCLUSIONS: Core data reported for proper interpretation of results were frequently not recorded and reported in studies investigating TI in adults. This makes it difficult to compare scientific reports, assess their value, and extrapolate to other EMS systems. Pre-hospital TI is a complex intervention, and terminology and study design must be improved to substantiate future evidence-based clinical practice.

Our economic analyses showed that sugammadex appears more cost-effective, where the value of any reduction in recovery time is greater, whereas the reduction in mortality compared with succinylcholine is non-significant and can result in lower possibilities of a CIVC event and for long procedures which do not require profound block throughout. Because of the lack of evidence, the value of some parameters remains unknown, which makes it difficult to provide a definitive assessment of the cost-effectiveness of sugammadex in practice. The use of sugammadex in combination with high-dose rocuronium is efficacious. Further research is needed to clarify key parameters in the analysis and to allow a fuller economic assessment.

DIA SYNTHESIS: A search of the literature revealed 7 studies that specifically evaluated clinical endpoints in septic adults receiving etomidate for induction prior to intubation. Three of the studies evaluated risk factors associated with adrenal insufficiency in critically ill patients. Each of these studies determined that etomidate exposure was independently associated with an inappropriate response to cosyntropin stimulation testing (CST). Two studies found no significant difference in hospital mortality rates when evaluating patients receiving etomidate compared with alternative agents in intensive care units. In patients exposed to etomidate, the majority of studies that evaluated the use of etomidate in sepsis were underpowered, leading to difficulty in establishing a causal relationship between drug-related adrenal insufficiency, morbidity, and mortality. CONCLUSIONS: Until further studies are available, etomidate should be reserved for hemodynamically unstable patients who cannot tolerate an alternative induction agent despite the administration of fluids or vasopressors.

RESULTS: In 13 studies, the unadjusted odds ratios (ORs) for an effect of pre-hospital intubation on in-hospital mortality ranged from 0.17 (favouring control interventions) to 2.43 (favouring pre-hospital intubation); adjusted ORs ranged from 0.24 to 1.42. Estimates for functional outcomes after TBI were equivocal. Three studies indicated higher risk of pneumonia associated with pre-hospital (when compared with in-hospital) intubation. CONCLUSIONS: Overall, the available evidence did not support any benefit from pre-hospital intubation and mechanical ventilation after TBI. Additional arguments need to be taken into account, including medical and procedural aspects.

BACKGROUND: Previous studies indicate that avoiding neuromuscular blocking agents (NMBAs) may be a risk factor for difficult tracheal intubation (DTI). RESULTS: The frequency of DTI was 5.1 (95% confidence interval (CI): 5.0-5.31). In a univariate analysis, avoiding NMBAs was associated with decreased DTI, odds ratio [OR] 1.52 (95% CI: 1.43-1.61), P < 0.0001. Using multivariate analysis, avoiding NMBAs was associated with decreased DTI, OR 1.52 (95% CI: 1.39-1.65; P < 0.0001). Among patients anaesthetised with non-depolarising NMBAs to be more at risk for DTI than those anaesthetised with depolarising NMBAs alone. CONCLUSIONS: Avoiding NMBAs may increase the risk of DTI. However, confounding by indication may be a problem in this observational study and systematic reviews with meta-analysis or more randomized clinical trials are needed.

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