AIRWAY SYSTEMATIC REVIEWS

A SUMMARY OF THE MAJOR TOPICS 2009-2018

Dr. David Lyness
@Gas_Craic

PART ONE

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Title	Journal	PMID	Authors		Abstract
Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review.	Eur Arch Otorhin	29255970	Adly 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 adult groups but with no significant difference in 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	29351759	Cabrini 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 thiopental had negative hemodynamic effects. No effect was found for use of a checklist, apneic oxygenation (on oxygenation and hemodynamics), videolaryngoscopy (on number and length of intubation attempts), sedatives and neuromuscular blockers (on hemodynamics). Finally, videolaryngoscopy was associated with severe adverse effects in multiple trials. **CONCLUSIONS: The limited available evidence supports a beneficial role of pre-oxygenation with NIV and HFNC before intubation of critically ill patients. Recruitment maneuvers may increase post-intubation oxygenation. Ramped position increased the number of intubation attempts; thiopental had negative hemodynamic effects and videolaryngoscopy might favor adverse events.**
Video Laryngoscopy for Endotracheal Intubation of Critically Ill Adults: A Systemic Review and Meta-Analysis.	Chest	28629915	Huang HB	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 conditions during tracheal intubation or direct laryngoscopy in adults and adolescents.	Cochrane Database Syst Rev	28513831	Lundstrom 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 (NMBA) to facilitate tracheal intubation is a widely accepted practice. However, because of adverse effects, NMBA may be undesirable. Cohort studies have indicated that avoiding NMBA 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. AUTHORS' CONCLUSIONS: This review supports that use of an NMBA may create the best conditions for tracheal intubation and may reduce the risk of upper airway discomfort or injury following tracheal intubation. Study results were characterized by indirectness, heterogeneity, and high or uncertain risk of bias concerning our primary outcome describing difficult tracheal intubation. **Therefore, we categorized the GRADE classification of quality of evidence as moderate to low. In light of defined outcomes of individual included trials, our primary outcomes may not reflect a situation that many clinicians consider to be an actual difficult tracheal intubation by which the patient's life or health may be threatened.**
Can High-flow Nasal Cannula Reduce the Rate of Endotracheal Intubation in Adult Patients With Acute Respiratory Failure?	Chest	28089816	Ni YN	2017 Apr	BACKGROUND: The effects of high-flow nasal cannula (HFNC) on adult patients with acute respiratory failure (ARF) are controversial. We aimed 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 3,881 patients were pooled in our final studies. As for ICU mortality and length of ICU stay, 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: Videolaryngoscopes 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 TT;	2016 Jul	RESULTS: The median time to intubation for patients intubated post induction was 16.0 min (interquartile range: 13 to 22) from entrance into the operating room. The median time to intubation for awake patients was 24.0 min (interquartile range: 19 to 31). The complication rate was 1.6% (17 of 1,085 cases). The most frequent complications observed were 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;Zhao G;Li L;Zhao	2016 Apr	RESULTS: Eighteen RCTs with a total of 2685 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 decreased the incidence of severe sore throat and hoarseness, but not cough. **CONCLUSION: 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.	PLoS One	26496440	Bossers SM;	2015	The search provided 733 studies, of which 6 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 twofold increase in the odds of mortality (OR 2.33, 95% CI 1.61 to 3.38, 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). C**ONCLUSIONS: Effects of prehospital endotracheal intubation depend on the experience of prehospital healthcare providers. Intubation by paramedics who are not well skilled to do so markedly 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 on the first rescue intubation in the emergency department	Scand J Trauma Resusc Emerg Med	25700237	Goto 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. CONCLUSION: 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 cardiopulmonary arrest.	Emerg Med J	25411398	Lalande E;Fournier	2014 Dec	A shortcut 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 answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of this best paper are tabulated. **It is concluded that transtracheal ultrasonography may be a supplementary tool for establishing 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.	Respirology	25208731	Luo J;	2014 Nov	This meta-analysis included six RCT involving 227 patients. The results showed that endotracheal intubation rate was lower in NIPPV (95% confidence interval (CI): 0.44-0.80, 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: 0.17-1.58, z = 1.16, P = 0.25). Only two studies discussed the aetiology of ALI/ARDS as pulmonary or extra-pulmonary, and neither showed statistical heterogeneity (I(2) = 0%, chi(2) = 0.31, P = 0.58), nor a significant difference in endotracheal intubation rate (95% CI: 0.35-9.08, z = 0.69, P = 0.49). **In conclusion, the early use of NIPPV can decrease the endotracheal intubation rate in patients with ALI/ARDS, but does not change the mortality of these patients.**
Pentax Airway Scope(R) vs Macintosh laryngoscope for tracheal intubation in adult patients: a systematic review and meta-analysis.	Anaesthesia	24820205	Hoshijima H;	2014 Aug	We included 17 randomised controlled trials with a total of 1801 participants. 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-1 laryngeal view was 2.40 (1.76-2.49) with the Pentax Airway Scope compared with the Macintosh laryngoscope, p < 0.00001. **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.**
Video laryngoscopy versus direct laryngoscopy for orotracheal intubation in the intensive care unit: a systematic review and meta-analysis.	Intensive Care Med	24556912	De Jong A;	2014 May	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 OTI [OR 0.29 (95% confidence interval (CI) 0.20-0.44, p < 0.001)], Cormack 3/4 grades [OR 0.26 (95% CI 0.17-0.41, p < 0.001)], and esophageal intubation [0.14 (95% CI 0.02-0.81, p = 0.03)] and increased the first-attempt success [OR 2.07 (95% CI 1.35-3.16, p < 0.001)]. No statistically 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 of ICU patients.**
BET 3: is rocuronium as effective as succinylcholine at facilitating laryngoscopy during rapid sequence intubation?	Emerg Med J	22337834	Herbstritt A;Amarakone	2012 Mar	A short-cut review was carried out to establish whether rocuronium is as effective as succinylcholine at facilitating laryngoscopy during rapid sequence intubation (RSI). A total of 94 papers was found using the reported search, of which seven represented the best 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.**
Comparison of video laryngoscopes with direct laryngoscopy for tracheal intubation: a meta-analysis of randomised trials.	Eur J Anaesthesiol	21897263	Su YC;	2011 Nov	RESULTS: Eleven trials with a total of 1196 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 -0.37-0.75). 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). **CONCLUSION: Video laryngoscopes are a good alternative to direct laryngoscopy during tracheal intubation. The advantage seems to be more prominent when difficult intubation is encountered.**
The association between obesity and difficult prehospital tracheal intubation.	Anesth Analg	21346165	Holmberg TJ;	2011 May	RESULTS: Of 80,501 patient contacts in whom 4114 TIs 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 6.8% (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. nontrauma). In comparison with the lean patient subgroup (BMI <30 kg/m(2)), patients with class III obesity (BMI >40 kg/m(2)) had a significant association with difficult TI (odds ratio 3.68; confidence interval [CI] 1.27-10.59), whereas those with class I/II obesity (BMI >/=30 kg/m(2) and <40 kg/m(2)) did not (odds ratio 0.98; CI 0.46 -2.07). **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 airway management challenges and strategies associated with obesity, including specific equipment, patient positioning, and practice recommendations that may facilitate both TI and alternative airway management techniques in this population.**
Revisiting the value of pre-hospital tracheal intubation: an all time systematic literature review extracting the Utstein airway core variables.	Crit Care	21244667	Lossius HM;	2011	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, 46 (78%) described services in which non-physicians conducted TI. In 12 of the 13 non-North American EMS systems, physicians performed the pre-hospital TI. 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 (max 21, min 2, IQR 8-12), and the median number of fixed system variables was 5 (max 11, min 0, IQR 4-8). Among the most frequently reported variables were 'patient 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 required 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 validity, 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.**
Sugammadex for reversal of neuromuscular block after rapid sequence intubation: a systematic review and economic assessment.	Br J Anaesth	20937718	Chambers D;	2010 Nov	Our economic analyses showed that sugammadex appears more cost-effective, where the value of any reduction in recovery time is greater, where the reduction in mortality compared with succinylcholine is greater, and where the patient is younger, for lower probabilities of a CICV 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.
Controversies surrounding the use of etomidate for rapid sequence intubation in patients with suspected sepsis.	Ann Pharmacother	20530707	Edwin SB;Walker P	2010 Jul-Aug	DATA 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 induction with etomidate compared with alternative regimens. Three studies found an increased risk of adrenal insufficiency 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 vasoactive agents.**
Pre-hospital tracheal intubation in patients with traumatic brain injury: systematic review of current evidence.	Br J Anaesth	19648153	von Elm E;	2009 Sep	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.**
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.	Br J Anaesth	19457894	Lundstrom LH;	2009 Aug	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): 5.0-5.3]%. In a univariate analysis, avoiding NMBA was associated with DTI, odds ratio (OR) 1.52 (95% CI: 1.43-1.61)%, P<0.0001. Using multivariate analysis, avoiding NMBA was associated with DTI, OR 1.48 (95% CI: 1.39-1.58), P<0.0001. Among patients intubated using NMBA, a multivariate analysis identified patients anaesthetized with only non-depolarizing NMBA to be more at risk for DTI than those anaesthetized with depolarizing NMBA alone. **CONCLUSIONS: Avoiding NMBA 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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