Video laryngoscopy versus direct laryngoscopy for endotracheal intubation in the emergency department and intensive care unit: a systematic review

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Abstract

Endotracheal intubation is a foundational skill of emergency and critical care clinicians. Direct laryngoscopy (DL) has long been the go-to method of intubation, but difficult airway characteristics can hinder clinicians' ability to intubate on their first attempt. Video laryngoscopy (VL) has been suggested as a tool to improve airway management in patients with problematic airway characteristics. Current data comparing DL to VL has produced inconsistent findings; however, this study found that the use of VL in patients undergoing emergent intubation was associated with greater overall first-pass success (FPS), while also increasing FPS in inexperienced clinicians and reducing the incidence of esophageal intubations.

Introduction

Overview:
- Traditionally endotracheal intubation is performed using a Miller or Macintosh type DL, where a clinician directly visualizes the vocal cords to help facilitate the placement of an endotracheal airway.

Problem:
- Difficult airway characteristics such as limited mouth opening, poor neck mobility, narrow dental arch, and decreased thyromental distance can hinder FPS with these devices
- Tools utilized to predict difficult tracheal intubation, such as the Modified Mallampati Classification or the LEMON scoring system, may predict the ease of laryngoscopy and intubation; however, it does not always guarantee FPS.

Proposed Solution:
- VL, which contains a miniature camera towards the blade's tip, have been proposed to improve airway management in difficult intubations. These devices help improve glottic visualization, theoretically increasing FPS and reducing complications related to endotracheal intubation.

Objective:
- This studies objective was to critically review the literature to investigate if there is evidence to suggest that VL results in more FPS and reduced complications compared to traditional DL in patients in need of emergent endotracheal intubation.

Methods

Literature Search:
- Performed from September 2021 to November 2021 using EBSCO and PubMed.

Search Terms:
- *EBSCO* – "endotracheal intubation OR intratracheal intubation AND video laryngoscope OR video laryngoscopy AND first-pass success rate"
- *PubMed* – "video laryngoscopy versus direct laryngoscopy AND first-pass intubation"

Criteria For Selection:
- Inclusion and exclusion criteria were established before beginning this search.
- An independent review of the article's abstracts, objectives, methods, results, and conclusions revealed that 12 were pertinent to the primary outcome of the research question.

Outcomes:
- *Primary* – first-pass success and complication rates
- *Secondary* – elements that may influence successful usage of VL and DL (i.e., clinician experience, type of video laryngoscope used)

Results

Study Characteristics:
- Twelve studies were included in this review.
- Methodologies included systematic reviews, RCT, and cohort studies.
- Intubation was attempted with VL in 9,261 patients and DL in 12,527 patients.
- A meta-analysis was performed using data from these studies.

First-Pass Success			
Objective	**% Success (VL vs. DL)**	**Test of Sig.**	**Odds Ratio, 95% CI**
Overall FPS	80% vs. 75%	z = 8.316 (p < 0.05)	1.35 [1.26–1.45]
Novice FPS	80% vs. 72%	z = 8.280 (p < 0.05)	1.63 [1.45, 1.83]
Experienced FPS	73% vs. 82%	z = 7.214 (p < 0.05)	0.59 [0.52, 0.68]
Type of VL	78% GVL vs. 84% CMAC	z = 4.917 (p < 0.05)	1.46 [1.25, 1.69]

Complications			
Objective	**% Incidence (VL vs. DL)**	**Test of Sig.**	**Odds Ratio, 95% CI**
Esophageal Intubation	1.3% vs 6.0%	z = 10.188 (p < 0.05)	4.93 [3.63, 6.70]
Airway Trauma	1.1% vs 1.5%	z = 1.131 (p = 0.26)	0.74 [0.44, 1.24]
Hypoxemia	16.9% vs. 12.9%	z = 4.496 (p < 0.05)	1.37 [1.19, 1.57]
Hypotension	7.5% vs. 6.4%	z = 0.763 (p = 0.45)	1.10 [0.86, 1.41]
Aspiration	2.3% vs. 2.6%	z = 0.648 (p = 0.52)	0.89 [0.62, 1.27]

Overall rate of first-pass intubation:
- All twelve studies reported an overall rate of FPS.
- Clinicians attempting emergent intubation were more likely to have FPS with VL when compared to DL.

Clinician experience:
- Five studies included data on FPS and clinical experience.
- 5,828 attempts by novice clinicians and 5,332 attempts by experienced clinicians.
- Novice clinicians were more likely to have FPS with VL.
- Experienced clinicians were less likely to have FPS with VL.

Type of video laryngoscope:
- Five studies with 2,988 intubations used the GlideScope VL (GVL), and five studies with 1,900 intubations used the CMAC VL.
- Clinicians were more likely to have first-pass success with the CMAC VL compared to the GVL.

Complication rates:
- Seven studies reported peri-intubation complications.
- Lower incidence of esophageal intubations using VL.
- The incidence of hypoxemia, defined as desaturation <80%, was higher using VL.
- No statistically significant difference in the incidence of airway trauma, hypotension, and aspiration between VL and DL.

Discussion

In this systematic review, pooled data from across 12 studies involving a total of 21,788 intubations were evaluated. This review focused on intubation in the ER and ICU, excluding operating room settings. Among the primary and secondary outcomes analyzed this study found that:

- Clinicians were 1.4x more likely to have FPS with VL compared to DL
- VL was associated with a lower incidence of esophageal intubation, but a higher incidence of hypoxemia.
- Inexperienced clinicians were 1.6x more likely to have FPS with VL, while experienced clinicians had better FPS with DL over VL.
- CMAC was 1.5x more successful in first-pass intubation compared to GVL

Conclusion

Overall, this study provides evidence to suggest that VL has greater FPS in critically ill patients in need of emergent endotracheal intubation while also reducing the incidence of esophageal intubation. Among the secondary outcomes analyzed, VL improved FPS in novice clinicians but hindered FPS in experienced clinicians. The C-MAC VL has proven to be a versatile intubation tool and is superior to the GVL. It allows for the flexibility to perform both DL and VL without the need to change out scopes if difficult airway characteristics arise. With so much unpredictability and the risk of adverse events, emergency medicine and ICU clinicians must have access to a quality video laryngoscope to successfully intubate on their first attempt. Nevertheless, further randomized controlled trials must be conducted to investigate the utility of VL over DL in the ED and ICU. Subsequent studies must account for confounding factors influencing FPS, such as the type of laryngoscope used and user experience.

References: Available upon request