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Review

Comparative Outcomes of Video vs. Direct Laryngoscopy in Adults in Critical Condition: A Narrative Review of First-Attempt Success, Complications, and Contextual Decision-Making

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ABSTRACT

Tracheal intubation emerges as a fundamental medical procedure for critically ill patients, facilitating the establishment of a secure airway and ensuring adequate oxygenation and ventilation. This narrative review compares video laryngoscopy (VL) and direct laryngoscopy (DL) in critically ill adults, evaluating three key parameters: first-attempt success rates, incidence of severe complications (hypoxemia, hemodynamic instability), and contextual factors influencing technique selection (patient anatomy, operator expertise, resource availability). Literature review found that challenges frequently arise in critically ill patients, influencing their respiratory, cardiovascular, and neurological systems. The primary techniques for tracheal intubation include DL and VL. Various studies have compared these techniques across diverse clinical scenarios. While some studies suggest potential advantages of VL, such as higher first-attempt success rates, others report no significant disparities. These findings underscore the inherent complexities in decision-making. To make an informed choice, considerations must include patient anatomy, operator experience, equipment availability, continuous monitoring, and adherence to clinical guidelines. Thus, the determination between DL and VL for intubating critically ill patients is multifaceted. Individual patient assessment, clinician proficiency, and resource accessibility are of paramount importance. Adherence to best practices and the ability to dynamically adapt to unforeseen challenges are critical aspects. Patient safety remains the highest priority, and these strategies provide a comprehensive framework for informed decision-making in critical scenarios. Ongoing research and continuous evaluation of clinical guidelines are essential endeavors to enhance our understanding of the most suitable technique for specific circumstances.

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Resultados comparativos de la video laringoscopia frente a la laringoscopia directa en adultos en estado crítico: Una revisión narrativa del éxito en el primer intento, complicaciones y toma de decisiones contextual

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RESUMEN

La intubación traqueal emerge como un procedimiento médico fundamental para pacientes en condición crítica, facilitando el establecimiento de una vía aérea segura y asegurando una adecuada oxigenación y ventilación. Esta revisión compara la video laringoscopia (VL) y la laringoscopia directa (DL) en adultos en estado crítico, evaluando tres parámetros clave: éxito en el primer intento, incidencia de complicaciones graves (hipoxemia, inestabilidad hemodinámica) y factores contextuales que influyen en la elección de la técnica (anatomía del paciente, experiencia del operador, disponibilidad de recursos). Después de la revisión de la literatura, se encontró que los desafíos se manifiestan con frecuencia en pacientes críticamente enfermos, afectando sus sistemas respiratorio, cardiovascular y neurológico. Las técnicas utilizadas principalmente para la intubación traqueal incluyen DL y VL. Diversos estudios han comparado estas técnicas en diversos escenarios clínicos. Mientras que algunos estudios sugieren posibles ventajas de la VL, como tasas de éxito elevadas en el primer intento, otros informan de ninguna disparidad significativa. Estos hallazgos subrayan las complejidades inherentes en la toma de decisiones. Para llegar a una elección informada, se deben considerar la anatomía del paciente, la experiencia del operador, la disponibilidad de equipos, el monitoreo continuo y la adherencia a las pautas clínicas. Entonces, la determinación entre DL y VL para la intubación de pacientes críticamente enfermos es multifacética. La evaluación individual del paciente, la habilidad del profesional y la disponibilidad de recursos son de importancia crucial. La adherencia a las mejores prácticas y la capacidad para adaptarse dinámicamente a desafíos imprevistos surgen como aspectos primordiales. La seguridad del paciente sigue siendo la máxima prioridad, y estas estrategias proporcionan un marco integral para la toma de decisiones informada en escenarios críticos. La investigación continua y la evaluación constante de las pautas clínicas son esfuerzos esenciales para mejorar nuestra comprensión de la técnica más adecuada para circunstancias específicas.

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1. INTRODUCTION

Orotracheal intubation (OIT) is considered a medical procedure of essential importance in the care of patients in critical conditions. Its relevance lies in the ability to establish and preserve a safe and adequate airway, which leads to the guarantee of oxygenation and ventilation in those individuals whose health is in an extremely delicate state. OIT becomes an essential tool in emerging medical situations, in the surgical context, in cases of trauma, and in the care provided to patients in intensive care units (ICU) [1].

For a thorough understanding of this dilemma, it is essential that the pathophysiology and specific physiologies of critically ill adult patients be analyzed. In the respiratory system, severe pathologies such as acute respiratory distress syndrome (ARDS) are manifested, which is characterized by lung inflammation, alveolar collapse, and reduced lung functional capacity [2]. For their part, the airways often experience obstruction, accumulation of secretions and edema, complications that can hinder the intubation process and increase the risk of hypoxemia [2].

As far as the cardiovascular system is concerned, dysfunction, such as septic shock, can aggravate both oxygenation and perfusion of organs. Hypoxemia, in turn, can potentiate this dysfunction. On the other hand, in the neurological system, the alteration in the level of consciousness may present difficulties for the patient's tolerance to the intubation procedure, and acute hypoxemia may have detrimental effects on the central nervous system. Under this complex panorama, the relevance of the

appropriate choice of intubation technique in critically ill patients is further highlighted. The primary objective of this narrative review is to comparatively analyze the performance of videolaryngoscopy (VL) versus direct laryngoscopy (DL) in critically ill adults, focusing on three key parameters: first-attempt success, incidence of complications (hypoxemia and hemodynamic instability), and clinical applicability based on contextual factors (operator experience, patient anatomy, and resource availability).

2. INTUBATION TECHNIQUES

More than 1.5 million critically ill adults undergo tracheal intubation annually in non-operating room settings in the U.S. [3, 4]. First-attempt failure occurs in 20-30% of emergency department or ICU intubations [5-7]. Additionally, international studies report life-threatening complications (e.g., severe hypoxemia, hemodynamic instability) in up to 28% of cases, with 2.7% of procedures complicated by cardiac arrest [8]. There are multiple techniques to perform tracheal intubation; however, at present, the most recognized and widely used are DL and VL [9].

2.1. DIRECT LARINGOSCOPY

DL is performed using a laryngoscope with a flat or curved blade inserted into the patient's mouth. The blade is manually manipulated to lift the tongue and epiglottis, allowing direct visualization of the vocal cords and tracheal access [10]. Once the glottis is visualized, the endotracheal tube is advanced into the trachea under direct line of sight (10). While DL is widely used and requires less specialized equipment, its efficacy varies depending on patient anatomy and operator skill [11-13].

2.2. VIDEO LARINGOSCOPY

VL utilizes a laryngoscope equipped with a small camera at the distal end of the blade. When inserted into the patient's mouth, the camera transmits real-time images of the airway structures to a screen, providing an enlarged and detailed view [10]. This enhanced visualization aids in navigating challenging anatomical scenarios, such as limited neck mobility or morbid obesity, and is particularly useful for training purposes [10].

2.3. TECHNIQUE SELECTION

The choice between DL and VL depends on several factors, including patient anatomy, operator expertise, and resource availability (Table 1) [11-13]. DL remains a cornerstone in routine intubations due to its simplicity and lower cost, whereas VL is often preferred in complex airway scenarios. Comparative studies evaluating these techniques are discussed in the following sections.

3. COMPARATIVE EVIDENCE BETWEEN DIRECT AND VIDEO LARYNGOSCOPY

Airway management is critical in emergencies, requiring reliable techniques for tracheal intubation. While direct laryngoscopy has been the standard for decades, video laryngoscopy offers enhanced anatomical visualization. This section synthesizes evidence from clinical trials comparing VL and DL in critically ill adults, focusing on first-attempt success rates, complications, and context-specific applicability.

In 2015, Silverberg et al [14] conducted a randomized controlled trial with 153 patients to evaluate whether VL with Glidescope would be superior to DL in urgent endotracheal intubation. The results showed that success in the first attempt was notably higher in the VL Glidescope group (74%) than in the DL group (40%) ($p< 0.001$). In the same year, Sanguanwit et al [15], in their randomized controlled trial, demonstrated that VL had greater success in the first attempt of intubation (73.1% vs. 58.8% for DL; $p = 0.060$). Additionally, the glottis view (Cormack-Lehane grade 1-2) with VL was significantly better (88.5%) than with DL (72.5%) ($p = 0.010$). Regarding immediate

Table 1: Risks and benefits according to the intubation technique

	Direct laryngoscopy	Video – laryngoscopy
Proceeds	- Widely used technique - Requires less specialized equipment - Potentially lower costs	- Provides an enlarged and improved view of anatomical structures. - Useful in cases of difficult intubation or in patients with complicated anatomy - Facilitates the teaching and training of health professionals.
Limitations	-Greater difficulty in patients with complicated anatomy. - Possibility of dental trauma or soft tissue injuries - Less visualization of the vocal cords in some cases.	- Higher cost due to additional equipment required. - Requires additional training - Possible need for availability of monitors and power supply.

complications, there were no significant differences [15].

In 2023, Prekker et al [16] conducted a multicenter randomized trial in 17 emergency departments and intensive care units. They demostrated that successful intubation on the first attempt occurred in 600 of 705 patients (85.1%) in the VL group and in 504 of 712 patients (70.8%) in the DL group (absolute risk difference: 14.3%; 95% confidence interval [CI]: 9.9%–18.7%; $p< 0.001$). A total of 151 patients (21.4%) in the VL group and 149 patients (20.9%) in the DL group experienced serious complications during intubation (absolute risk difference: 0.5%; 95% CI: −3.9–4.9). The authors concluded that VL resulted in a higher incidence of successful first-attempt intubation compared to DL [16].

However, some studies show contrasting findings. For example, Kim et al [17] compared the performance of endotracheal intubation (EIT) during cardiopulmonary resuscitation (CPR) between DL and VL (GlideScope®) in 2016. They analyzed 140 EITs performed by experienced intubators (69 with DL and 71 with VL) and found no significant differences in EIT success rates, first-attempt success rates, or time to EIT completion [17].

Similarly, Bhattacharjee et al [18] conducted a 2018 meta-analysis of randomized controlled trials comparing VL and DL for EIT in adult emergency department patients. Their results showed no advantage for VL over DL in first-attempt success rates (odds ratio [OR]: 1.28; 95% CI: 0.70–2.36; $p = 0.42$), overall intubation success rates (OR: 1.26; 95% CI: 0.53–3.01; $p= 0.6$), or in-hospital mortality (OR: 1.25; 95% CI: 0.8–1.95; $p= 0.32$). However, VL significantly reduced esophageal intubation rates (OR: 0.09; 95% CI: 0.01–0.7; $p = 0.02$). In the same year, Gao et al (19) reported no significant difference in first-pass intubation success rates between VL (67.9%) and DL (69.5%; $p= 0.824$). Overall intubation success, total attempts, and procedure duration also did not differ between groups (19).

Finally, Kreutziger et al [20] conducted a 2019 multicenter randomized controlled trial comparing VL (McGrath Mac) and DL for prehospital emergency intubation in air rescue patients. The primary outcome of successful tracheal intubation was equivalent between DL (98.5%, $n = 254/258$) and VL (98.1%, $n = 251/256$), with a difference of 0.4% (99% CI: −2.58–3.39). There were no statistically significant differences in intubation times, number of attempts, or perceived difficulty. However, switching devices after a failed first attempt was more successful than repeating the same technique [20].

4. ASSESSMENT OF EVIDENCE QUALITY FROM STUDIES EVALUATING DIRECT LARYNGOSCOPY VERSUS VIDEO LARYNGOSCOPY

4.1. METHODOLOGICAL APPROACH

To evaluate the validity and quality of the limited available evidence pertaining to the research question, a meta-research analysis was conducted, with a focus on the methodological quality of study designs. The 'Consolidated Standards of Reporting Trials' (CONSORT) questionnaire was employed for this purpose. Two authors, with any discrepancies resolved by a third author, although such intervention ultimately proved unnecessary, independently assessed compliance with the criteria for each study design. The CONSORT 2010 checklist comprised 6 sections, 25 topics, and 37 items. A score of 1 point was assigned to each item if the description was complete, resulting in a maximum score of 37 points for an article. If an item lacked a description, it received a score of 0 points. The item scores were aggregated for each article, and this total was divided by the number of items, which was determined by subtracting the count of irrelevant items excluded from the overall total. The resulting value was used to calculate the reporting rate, expressed as a percentage. Furthermore, individual item reporting rates were computed by dividing the total relevant item score for articles in which the item was reported by the number of articles extracted in that period and expressed as a percentage.

In terms of compliance, Bhattacharjee et al [17], Kreutziger et al [18] and Kim et al [20], reach the highest percentage, all with a solid 84%. They comply with most of the items in the CONSORT checklist, reflecting a meticulous presentation of information and methodology in their clinical trials.

Prekker et al [16] and Sanguanwit et al [17] also exhibit reasonably high compliance, at 80% and 72% respectively. Although they address numerous items, they have deficiencies in some respects, which could affect the quality of the presentation of their studies. In contrast, Gao et al [20] has the lowest compliance, with 56%. This low figure suggests non-compliance compared to other articles, which compromises the presentation and methodological robustness of their study [15, 21].

Figure 1 displays the percentage of compliance with individual items. It is evident that most articles adhered to these criteria. However, it is noteworthy that for the items assessing the results (17a, 17b, and 18), only about 50% of the articles met the specified criteria.

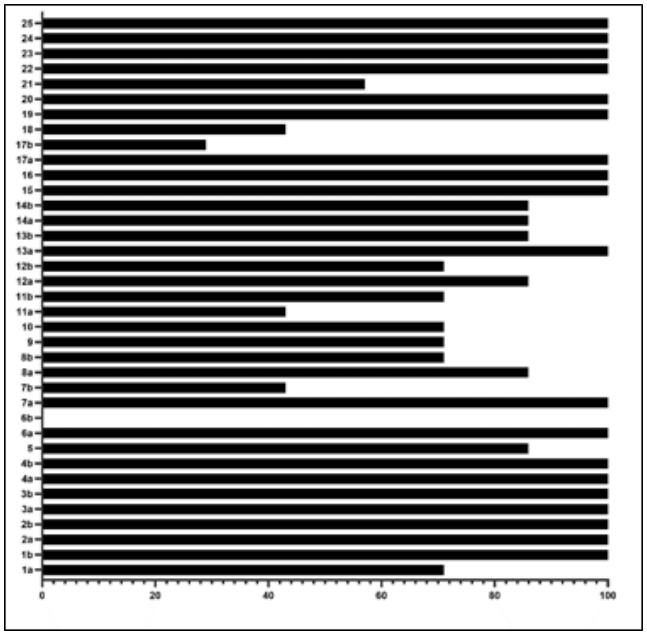

***Figure 1**: Percentage of compliance with individual items in the studies about use of video-laryngoscopy compared with direct laryngoscopy in critical ill patients.*
Source: Own elaboration based on the analysis of CONSORT checklist compliance in the included studies (14–20).

4.2. STRATEGIES TO CONSIDER WHEN CHOOSING THE MOST APPRPRIATE TECHNIQUE FOR INTUBATION IN CRITICAL ILL PATIENTS

The choice between DL and VL in the intubation of critically ill patients is a complex process that requires careful consideration. Below are clear strategies for determining when it is appropriate to use each technique, based on evidence and clinical experience:

A. **Individual Case Evaluation:** The first crucial step is to evaluate the clinical situation of each patient individually. This includes considering the anatomy of the patient's airway. DL may be preferable in patients with normal airway anatomy or when routine intubation is required. On the other hand, VL may be more beneficial in patients with complicated anatomy, such as those with morbid obesity, facial trauma, or limitations in neck mobility [21-23].

B. **Training and Experience:** The training and experience of medical staff are crucial factors in the choice of technique. It should be ensured that professionals are well trained and experienced in both techniques. An operator with strong skills in DL may opt for this technique in situations where they feel more comfortable and confident. On the other hand, if a professional has advanced experience and skills in VL, this technique might be preferable in challenging situations [21, 24].

C. **Available Equipment:** The availability of equipment and resources is a practical aspect that should also be considered. VL usually requires additional equipment, such as monitors and power supply for the VL. Before deciding, make sure the necessary resources are available and functioning properly [25, 26].

D. **Continuous Monitoring:** During the intubation procedure, continuous monitoring is essential. This includes measuring the patient's oxygen saturation, blood pressure, and heart rate. Constant monitoring will allow you to detect complications, such as hypoxemia or hemodynamic instability, early. If problems arise, you may consider switching intubation techniques in real time to ensure patient safety.

E. **Reevaluation of Technique:** If the first attempt at intubation is unsuccessful, rather than repeating the same technique, it is important to consider a change of approach. For example, if DL was initially attempted and successful intubation was not achieved, it might be prudent to switch to VL rather than insisting on the same technique that did not work. This flexibility can be vital in critical situations.

F. **Clinical Guidelines Update:** Hospitals and intensive care units should regularly review and update their clinical guidelines to reflect the latest evidence. These guidelines should provide clear guidelines on when it is appropriate to use each intubation technique. In addition, recommendations from medical societies and health care organizations should be considered to ensure alignment with current best practices [25].

G. **Continuous Research:** Research is critical to improving our understanding of when and why one technique may be more beneficial than the other in specific situations may. Ongoing clinical studies and systematic reviews should be conducted to evaluate the effectiveness and safety of both techniques in various clinical scenarios. Keeping up with up-to-date medical literature is essential for making informed decisions in clinical practice.

5. LIMITATIONS

When analyzing the limitations of this study, we identified

methodological and contextual aspects that may influence the interpretation of the results. First, as a narrative review, there is an inherent risk of selection bias due to the absence of a standardized systematic protocol for search, selection, and critical appraisal of included studies. This limits the reproducibility and transparency of the process and increases the likelihood of omitting relevant evidence or prioritizing findings that support specific conclusions. Although studies with varied designs—randomized controlled trials, observational studies, and meta-analyses—are cited, the heterogeneity in their populations (e.g., clinical settings, patient acuity) and outcome definitions (e.g., first-attempt success, complications) hinders direct comparisons and generalizability of results. For instance, studies in cardiopulmonary resuscitation (CPR) settings reported neutral outcomes between VL and DL, while those in ICU or emergency contexts highlighted advantages of VL, suggesting that specific clinical scenarios may modulate the efficacy of each technique.

Additionally, we identified limitations in controlling key variables, such as operator experience and the type of VL device used. While the research acknowledges that practitioner expertise influences technique selection, it does not delve into how this factor was addressed in the included studies. It is plausible that operators in some studies had greater proficiency in one technique over the other, skewing results toward their preferred method. Similarly, factors such as adjunctive medication use, preoxygenation, or patient comorbidities—critical determinants of intubation success—were not comprehensively analyzed, leaving gaps in understanding their impact on outcomes. Furthermore, publication bias was not discussed, as studies with null or negative results are less likely to be published, potentially distorting the synthesis of current evidence.

These limitations underscore the need for future research with more robust and standardized designs. Priority should be given to multicenter trials controlling variables such as operator experience, specific VL devices used, and patient anatomical or clinical characteristics (e.g., morbid obesity, facial trauma). Updated meta-analyses evaluating heterogeneity through subgroup stratification by clinical context (CPR, ICU, emergency) could clarify existing discrepancies. It is also crucial to explore the cost-effectiveness of both techniques across settings, as well as longitudinal studies assessing long-term outcomes, such as laryngeal injury incidence or associated mortality. Only through rigorous, multidimensional approaches will it be possible to establish precise recommendations tailored to the complexities of each critical care scenario.

6. CONCLUSIONS

Current evidence demonstrates that video laryngoscopy (VL) significantly improves first-attempt intubation success rates compared to direct laryngoscopy (DL) in critically ill adults, particularly in patients with challenging airway anatomy, such as morbid obesity or restricted cervical mobility. This advantage is attributed to VL's superior glottis visualization and its ability to reduce esophageal intubation. However, both techniques share comparable rates of severe complications, underscoring that patient safety depends not only on device selection but also on operator expertise and the patient's physiological stability.

Based on these findings, we recommend prioritizing VL in well-resourced settings, such as intensive care units and emergency departments, where trained operators anticipate difficult airways. In contrast, DL remains a pragmatic choice in resource-limited contexts, such as prehospital care or cardiopulmonary resuscitation (CPR), where immediate access to VL may be impractical. Standardized simulation-based training programs for VL are critical, as its benefits diminish without technical proficiency.

Critical uncertainties persist, including inconsistent definitions of "first-attempt success" and limited evidence on VL's cost-effectiveness. Future research should prioritize standardized clinical trials using explicit metrics (e.g., first-pass success without hypoxemia), economic evaluations of VL's long-term clinical impact, and technological innovations, such as portable VL devices or AI-assisted systems, to broaden accessibility.

In conclusion, while the choice between VL and DL must align with clinical context and resource availability, VL should be the first-line technique in critical care environments with trained operators. Patient safety demands a dynamic, evidence-driven approach, integrating technological advancements, specialized training, and multidisciplinary collaboration to address existing gaps. The future of airway management hinges on equitable access to innovations and a commitment to advancing best practices through rigorous, patient-centered research.

7. CONFLICT OF INTERESTS

The authors have no conflict of interest to declare. The authors declared that this study has received no financial support.

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