

THE CRITICAL AIRWAY: WHEN ANATOMY IS NOT THE ONLY PROBLEM

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Background

Tracheal intubation is one of the most frequently performed life-saving procedures in modern anesthesia and critical care. Traditionally, difficult airway management has focused primarily on anatomical predictors of difficult facemask ventilation, laryngoscopy, and tracheal intubation. However, critically ill patients may experience severe peri-intubation complications despite an anatomically uncomplicated airway. Hypoxemia, hypotension, severe metabolic acidosis, and right ventricular dysfunction can make induction of anesthesia and transition to positive-pressure ventilation physiologically hazardous [1–3].

The concept of the physiologically difficult airway emphasizes that successful tracheal intubation does not necessarily equate to successful airway management. In critically ill populations, peri-intubation hypoxemia, cardiovascular collapse, and cardiac arrest remain important adverse events [3,4].

Objective

This presentation aims to introduce a physiology-first approach to the critical airway, emphasizing recognition and optimization of physiological risk before induction rather than focusing exclusively on anatomical airway difficulty.

Content

The presentation proposes a practical framework based on four major physiological threats: severe hypoxemia, characterized by limited oxygen reserve, rapid desaturation, and intolerance of apnea; hemodynamic instability, related to loss of sympathetic tone, reduced venous return, and cardiovascular collapse following induction and positive-pressure ventilation; severe metabolic acidosis, in which compensatory hyperventilation may be essential for maintaining pH and interruption of spontaneous ventilation can precipitate rapid deterioration; and right ventricular failure, particularly in patients with pulmonary embolism, pulmonary hypertension, or severe acute hypoxic pulmonary vascular disease.

For each threat, the presentation addresses three questions: How is the risk recognized? Why is induction dangerous? How should the airway strategy be modified?

Particular emphasis is placed on pre-intubation optimization, including advanced preoxygenation strategies, non-invasive ventilation or high-flow nasal oxygen when appropriate, hemodynamic optimization, individualized selection and dosing of induction agents, and preservation of spontaneous ventilation in selected patients. Consensus recommendations for the physiologically difficult airway support an individualized approach to pre-intubation optimization and airway management [2]. Current difficult-airway guidance also supports considering awake airway management when patients are unlikely to tolerate even brief apnea or when airway rescue may be challenging [5].

Point-of-care ultrasound (POCUS) is incorporated as a rapid bedside tool for identifying relevant physiological abnormalities, including right ventricular dysfunction, left ventricular systolic function, and pulmonary pathology that may alter the airway plan. Ultrasound is an adjunct to, rather than a substitute for, clinical assessment and preparation.

The presentation also distinguishes a difficult airway from a critical airway. While a difficult airway primarily concerns technical challenges, a critical airway requires simultaneous management of airway anatomy and physiological reserve. Risk may therefore arise from the patient's inability to tolerate apnea, induction, or positive-pressure ventilation [1–4].

Conclusion

The most dangerous airway may not be the airway that is difficult to intubate, but the airway attached to a patient who cannot tolerate induction, apnea, or positive-pressure ventilation. A successful airway strategy should therefore begin before the laryngoscope enters the mouth. Recognition of physiological risk, optimization of oxygenation and circulation, appropriate selection of technique and drugs, and anticipation of peri-intubation deterioration are essential components of modern critical airway management.

The central question should shift from: “Can I intubate this patient?” to: “Can this patient tolerate intubation?”

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