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Managing the Difficult Airway in Critically Ill COVID-19 Patients: A Case Series and Lessons Learned

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Abstract

Background: The COVID-19 pandemic has placed anesthesiologists at the forefront of managing critically ill patients requiring emergency tracheal intubation. The unique challenges posed by difficult airways, combined with the risks of viral transmission, have necessitated significant modifications in airway management protocols. **Objective:** This case series of three emergency intubations highlights the practices, experiences, and challenges encountered by anesthesiologists during emergency tracheal intubation of critically ill COVID-19 patients with difficult airways in a tertiary referral hospital in the Philippines. **Methods:** We present three cases of emergency intubations in COVID-19 patients with difficult airways, defined using modified Mallampati classification ≥3, limited mouth opening (<3 cm), reduced neck extension (<35˚), or anatomical distortion. Success rates and patient outcomes were tracked through hospital discharge. **Results:** All three patients (79-year-old female with comorbidities, 28-year-old male with morbid obesity, 42-year-old female with neck mass) presented unique airway challenges. Success rates were 33% on the first attempt, and 67% on the second attempt, with one case requiring surgical airway. All patients survived to ICU admission with successful airway management. Hospital policies were subsequently updated to mandate early anesthesiology consultation for anticipated difficult airways. **Conclusions:** Emergency tracheal intubation in COVID-19 patients with difficult airways presents significant challenges. Videolaryngoscopy, multidisciplinary teamwork, hemodynamic optimization, and early intubation referral improve outcomes while protecting healthcare workers.

Keywords

COVID-19, Difficult Airway, Emergency Intubation, Videolaryngoscopy,

PPE, Multidisciplinary Approach

1. Background

Airway management remains one of the most critical and challenging aspects of anesthesia, with significant implications for patient morbidity and mortality [1]. A difficult airway is clinically defined as a scenario in which a trained anesthesiologist encounters difficulty with mask ventilation (inability to maintain oxygen saturation >90% or detect exhaled CO_2), tracheal intubation (requiring >2 attempts or >10 minutes), or both, often associated with specific anatomical predictors including modified Mallampati classification ≥3, limited mouth opening (<3 cm), reduced thyromental distance (<6 cm), decreased neck extension (<35˚), or pathological airway distortion.

The COVID-19 pandemic has significantly amplified these challenges through multiple mechanisms [2] [3]. The virus causes severe respiratory failure with increased oxygen demand, airway inflammation leading to anatomical distortion, and hemodynamic instability requiring rapid intervention. Additionally, aerosol-generating procedures during intubation pose substantial infection risks to healthcare workers, necessitating modified protocols and extensive personal protective equipment that can impair dexterity and visualization [4].

Previous studies have documented varying approaches to COVID-19 airway management globally, with success rates for first-pass intubation ranging from 84% - 96% in experienced centers [5] [6]. However, limited data exist specifically addressing difficult airway management in COVID-19 patients within resource-constrained settings such as the Philippines, particularly in emergency out-of-operating-room scenarios where optimal equipment and personnel may not be immediately available.

During the pandemic, several key adaptations emerged in airway management practices, including universal videolaryngoscopy use, modified rapid sequence induction protocols, enhanced PPE requirements, and multidisciplinary team approaches [2] [5]. The integration of these strategies with traditional difficult airway algorithms required careful consideration of both patient safety and healthcare worker protection, leading to institution-specific protocol modifications that balanced efficacy with infection control measures [7].

2. Case Presentations

Case 1: 79-Year-Old Female with Acute Respiratory Failure

Patient Profile: A 79-year-old female (BMI 32 kg/m^2) presented with acute hypoxemic respiratory failure secondary to COVID-19 pneumonia, complicated by severe community-acquired pneumonia, acute hepatitis, and metabolic syndrome. Airway assessment revealed Mallampati Class 4, limited mouth opening (2.5 cm), and significant facial edema consistent with fluid overload.

Pre-intubation Status: Vital signs included blood pressure 90/60 mmHg, heart rate 110 bpm, oxygen saturation 60% on high-flow nasal cannula (60 L/min, FiO_2 1.0). Laboratory values showed elevated inflammatory markers (CRP 180 mg/L, ferritin 2400 ng/mL) and evidence of multi-organ dysfunction.

Intubation Protocol: Following institutional COVID-19 airway protocol [5], the patient was positioned with head-of-bed elevation to 30˚ within an aerosol containment box. The team included two anesthesiologists, one respiratory therapist, and one nurse, all wearing Level 4 PPE with powered air-purifying respirators (PAPR). Pre-oxygenation was performed using a bag-valve mask with a viral filter for 3 minutes. Modified rapid sequence induction included midazolam 2 mg, fentanyl 50 mcg, propofol 80 mg, and rocuronium 80 mg.

Technical Details: A McGrath videolaryngoscope with D-blade was selected due to anticipated airway edema and obesity-related anatomical changes. The first attempt failed due to Grade 4 laryngoscopy view with significant airway edema obscuring landmarks. Bag-valve-mask ventilation proved challenging with a leak around the mask requiring a two-handed technique. The second attempt using a bougie was unsuccessful due to copious bloody secretions and further airway distortion from initial trauma. After thorough suctioning and repositioning to optimize the sniffing position, the third attempt achieved successful intubation using a size 7.0 endotracheal tube with confirmatory capnography.

Post-intubation Management: Immediate post-intubation hypotension (systolic BP 70 mmHg) was managed with norepinephrine infusion initiated at 0.1 mcg/kg/min and IV fluid bolus. Chest X-ray confirmed appropriate tube placement. The patient was transferred to the ICU on mechanical ventilation with lung-protective strategies.

Outcome: Patient remained intubated for 14 days, was successfully extubated, and discharged home after 28 days with complete neurological recovery.

Case 2: 28-Year-Old Male with Morbid Obesity

Patient Profile: A 28-year-old male weighing 160 kg (BMI 51 kg/m^2) with acute respiratory failure secondary to COVID-19 pneumonia, complicated by morbid obesity, severe obstructive sleep apnea (AHI 45 events/hour), and metabolic syndrome. Airway assessment revealed Mallampati Class 4, severely limited neck extension, large neck circumference (48 cm), and receding mandible consistent with high aspiration risk [8].

Pre-intubation Status: Vital signs showed blood pressure 140/90 mmHg, heart rate 95 bpm, oxygen saturation 75% despite bilevel positive airway pressure (BiPAP) at maximum settings. Arterial blood gas revealed severe hypoxemia (PaO_2 55 mmHg) with compensated respiratory acidosis.

Intubation Protocol: Given the extremely high risk of failed intubation [6], a surgical airway team, including an otolaryngology resident and a general surgery resident, was placed on immediate standby with a tracheostomy tray prepared. The procedure was performed in a negative-pressure room with enhanced infection control measures [4]. Initial awake fiberoptic intubation was attempted using

topical anesthesia with lidocaine and conscious sedation with dexmedetomidine.

Technical Details: The first awake intubation attempt failed due to patient agitation and copious secretions despite adequate topicalization. A second attempt using modified rapid sequence induction with ketamine 100 mg and succinylcholine 200 mg also proved unsuccessful due to Grade 4 laryngoscopy view complicated by pink frothy pulmonary edema secretions that obscured visualization despite continuous suctioning. Bag-valve-mask ventilation was extremely difficult, requiring a three-person technique.

Surgical Airway: After two failed intubation attempts and considering the patient's rapid desaturation to 45% oxygen saturation, the decision was made to proceed with emergency surgical airway [1]. A percutaneous tracheostomy was performed under local anesthesia using the Seldinger technique with real-time ultrasound guidance to identify vascular structures. The procedure was completed successfully within 8 minutes, resulting in immediate improvement in oxygenation to 92%.

Outcome: Patient tolerated the tracheostomy well, was weaned from mechanical ventilation after 21 days, underwent successful tracheostomy decannulation, and was discharged home after 35 days with no residual complications.

Case 3: 42-Year-Old Female with Neck Mass

Patient Profile: A 42-year-old female presented with acute respiratory failure and a large bleeding anterolateral neck mass (8 cm × 6 cm) with suspected squamous cell carcinoma based on imaging characteristics. The mass caused significant anatomical distortion, resulting in tracheal deviation and compression. Additional comorbidities included chronic obstructive pulmonary disease and prior radiation therapy to the neck region.

Pre-intubation Status: Vital signs were blood pressure 110/70 mmHg, heart rate 105 bpm, and oxygen saturation 85% on high-flow oxygen. CT imaging revealed significant tracheal compression at the level of the thyroid cartilage with an estimated 60% luminal narrowing and rightward deviation.

Intubation Protocol: Due to the anticipated extremely difficult airway with high risk of complete airway obstruction [1], the procedure was performed in the operating room rather than the ICU. The multidisciplinary team included two anesthesiologists, two otolaryngologists, and a general surgeon, all prepared for immediate surgical anterior neck access or emergency tracheostomy.

Technical Details: A CMAC videolaryngoscope with D-blade was selected as the primary tool. Awake fiberoptic intubation was initially considered but deemed unsafe due to bleeding risk and anatomical distortion. Modified rapid sequence induction was performed with careful hemodynamic monitoring. The first attempt revealed a Grade 3 laryngoscopy view with significant airway distortion and active bleeding obscuring the vocal cords. After repositioning and improved suctioning technique, the second attempt achieved successful intubation using a smaller endotracheal tube (size 6.5) with stylet guidance around the deviated anatomy.

Outcome: Patient was successfully intubated and underwent tumor debulking surgery the following day. She remained intubated for 5 days post-operatively, was successfully extubated, and discharged after 12 days for outpatient oncology follow-up.

3. Results and Outcomes

Overall Success Rates: Among the three cases, first-pass intubation success was achieved in 1/3 cases (33%), with second-pass success in 2/3 cases (67%). One case required surgical airway management. All patients survived to ICU admission with successful airway management.

Institutional Impact: Following this case series, hospital policies were updated to mandate early anesthesiology consultation for any COVID-19 patient with anticipated difficult airway predictors [1]. A formal difficult airway protocol was implemented requiring videolaryngoscopy as a first-line technique and surgical backup for high-risk cases.

Healthcare Worker Safety: No healthcare workers involved in these cases developed COVID-19 infection, validating the effectiveness of enhanced PPE protocols and aerosol containment measures [4] [6].

4. Discussion

The management of difficult airways in critically ill COVID-19 patients represents a complex clinical scenario requiring integration of traditional airway management principles with pandemic-specific considerations [2] [5]. This case series demonstrates several critical learning points that have broader implications for emergency airway management during respiratory pandemic situations.

Modified Airway Assessment in COVID-19 Context

Traditional difficult airway prediction tools required modification during the COVID-19 pandemic due to several factors [7]. Disease-related airway changes including mucosal edema, increased secretions, and inflammatory responses altered normal anatomical relationships. Additionally, the urgency of clinical deterioration often precluded comprehensive airway assessment, necessitating assumption of difficult airway status in high-risk patients. Our cases illustrate how COVID-19-specific factors such as severe hypoxemia, hemodynamic instability, and increased aspiration risk compound traditional difficult airway predictors [3].

Impact of Personal Protective Equipment on Airway Management

The use of enhanced PPE, while essential for infection control, significantly impacted intubation performance [4] [6]. Level 4 PPE including powered air-purifying respirators reduced tactile feedback and limited range of motion, while face shields and goggles created fogging issues despite anti-fogging measures. Communication barriers between team members wearing full protective equipment required development of clear hand signals and predetermined role assignments. These challenges necessitated extended preparation time and heightened awareness of equipment limitations during critical procedures.

Videolaryngoscopy as Standard of Care

Videolaryngoscopy emerged as the preferred technique for COVID-19 intubations due to multiple advantages including improved glottic visualization in edematous airways, increased distance between operator and patient reducing aerosol exposure, and enhanced teaching opportunities for less experienced providers [2] [5]. Our experience with different blade types (D-blade, CMAC) demonstrated the importance of having multiple videolaryngoscope options available, as optimal blade selection varied based on individual patient anatomy and pathology.

Hemodynamic Considerations and Optimization

COVID-19 patients frequently presented with hemodynamic instability due to systemic inflammatory response, dehydration, and cardiovascular complications [3] [7]. Pre-intubation hemodynamic optimization using vasopressors and careful induction agent selection proved crucial for preventing cardiovascular collapse. The use of ketamine as an induction agent provided hemodynamic stability while maintaining respiratory drive, though careful dosing was required to avoid hypertensive responses in patients with underlying cardiac disease.

Multidisciplinary Team Approach and Resource Allocation

Successful management of these complex cases required coordinated multidisciplinary teams including anesthesiology, otolaryngology, intensive care, and respiratory therapy [5]. Pre-procedure huddles became essential for role clarification, equipment preparation, and contingency planning. The availability of surgical backup proved crucial in Case 2, where surgical airway became necessary. Resource allocation considerations included dedicated COVID-19 airway teams, specialized equipment reserves, and coordinated scheduling to minimize cross-contamination risks [6].

Quality Improvement and Protocol Development

This case series led to significant institutional protocol modifications including mandatory videolaryngoscopy for COVID-19 intubations, required anesthesiology consultation for predicted difficult airways, enhanced PPE training programs, and development of COVID-19-specific airway carts with specialized equipment [2]. Regular simulation training sessions were implemented to maintain team proficiency in modified protocols under PPE constraints.

Psychological and Human Factors

The high-stress environment of COVID-19 airway management, combined with PPE limitations and infection concerns, significantly impacted provider performance [4]. Recognition of cognitive load factors led to implementation of cognitive aids, structured communication protocols, and peer support programs for healthcare workers involved in high-risk procedures.

5. Recommendations

Institutional Protocol Development

Healthcare institutions should develop comprehensive COVID-19 airway man-

agement protocols that integrate infection control measures with difficult airway guidelines [1] [5]. These protocols should include clear criteria for anesthesiology consultation, mandatory videolaryngoscopy policies, surgical backup requirements, and enhanced PPE specifications. Regular protocol updates based on emerging evidence and institutional experience are essential for maintaining optimal outcomes.

Team Training and Simulation

Regular multidisciplinary simulation training under full PPE conditions is crucial for maintaining technical skills and team coordination [2]. Training scenarios should include various difficult airway presentations, equipment failures, and emergency surgical airway procedures. Debriefing sessions should focus on both technical performance and communication effectiveness under challenging conditions.

Equipment and Resource Management

Institutions should maintain dedicated COVID-19 airway equipment including multiple videolaryngoscope systems, enhanced PPE supplies, aerosol containment devices, and surgical airway kits [5] [6]. Equipment maintenance and staff training on various systems ensures readiness for different clinical scenarios. Cost-benefit analyses should consider both patient outcomes and healthcare worker safety when making equipment decisions.

Quality Assurance and Outcome Monitoring

Systematic tracking of airway management outcomes including success rates, complications, and healthcare worker exposures provides essential feedback for protocol refinement [7]. Regular case reviews and morbidity/mortality conferences help identify improvement opportunities and share lessons learned across the institution.

Research and Evidence Generation

Continued research into optimal airway management strategies during respiratory pandemics is essential for evidence-based protocol development [3] [8]. Areas requiring further investigation include comparative effectiveness of different videolaryngoscope systems, optimal PPE configurations balancing protection with performance, and long-term outcomes of patients requiring emergency airway management during COVID-19.

Limitations

This case series has several limitations that must be acknowledged. The small sample size of three cases limits generalizability of findings, though each case provides valuable insights into different aspects of difficult airway management during COVID-19. The single-center experience may not reflect practices and outcomes in other healthcare settings with different resources and patient populations. Additionally, the retrospective nature of outcome reporting may have introduced bias in data collection and interpretation. Long-term patient outcomes beyond hospital discharge were not systematically tracked, limiting assessment of overall impact on patient quality of life and functional status.

6. Conclusion

Emergency tracheal intubation in COVID-19 patients with difficult airways presents unprecedented challenges requiring integration of traditional airway management principles with pandemic-specific modifications [1] [2]. This case series demonstrates that successful outcomes are achievable through systematic approaches incorporating videolaryngoscopy, multidisciplinary teamwork, hemodynamic optimization, and early subspecialty consultation. The lessons learned from these cases have informed institutional protocol development and highlight the importance of continued preparedness for managing complex airways during respiratory pandemic situations.

While COVID-19 has transitioned from pandemic to endemic status, the risk of future respiratory outbreaks with similar challenges remains significant [7]. The protocols, training programs, and institutional changes developed during this pandemic provide a foundation for managing complex airway scenarios in critically ill patients regardless of underlying etiology. Continued research, protocol refinement, and maintenance of enhanced capabilities will ensure optimal outcomes for future patients requiring emergency airway management under challenging conditions [3] [5].

Healthcare systems must maintain the enhanced multidisciplinary approaches, advanced equipment capabilities, and institutional knowledge gained during the COVID-19 pandemic to provide optimal care for all patients with difficult airways [6] [8]. The integration of these lessons into standard practice represents a positive legacy of the pandemic experience, ultimately improving outcomes for all patients requiring emergency airway management [4].

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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