Current Anesthesiology Reports
https://doi.org/10.1007/s40140-024-00650-z

Management of the Traumatized Airway

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Accepted: 14 August 2024

Abstract

Purpose of Review To discuss the challenges associated with airway management in patients with airway trauma and provide evidence-based management strategies.

Recent Findings Patients with traumatic injury to the airway have both anatomic and physiologic challenges associated with airway management. Appropriate choice of airway management tools, induction agents and pre-procedural patient optimization are important.

Summary Management of a traumatized airway requires a coordinated multidisciplinary approach and the impact of choice of drugs, airway devices and tools to optimize patients prior to the procedure on outcomes needs further exploration.

Keywords Airway management · Trauma · Physiologically difficult airway

Introduction

Airway injuries are common in trauma and are a major cause of early mortality [1, 2]. These injuries may be a result of either blunt or penetrating injuries to pharynx, larynx, and/or the tracheobronchial tree, thermal and burn injuries, chemical ingestion, or sequelae of underlying disease processes that changes the integrity of the airway tissues. Accurate statistics are elusive, as many patients with traumatic airway injuries do not survive long enough to reach a hospital, and most evidence comes from single-center registry data or case reports. Previous studies have estimated that 2.5 to 3.2% of patients that die from trauma have associated injuries to the tracheobronchial tree [2]. Though less easily recognized than penetrating injuries, blunt neck injuries often lead to greater morbidity and mortality. This may be due to the delayed presentation, going unrecognized for longer periods of time and being less amenable to immediate surgical correction [3]. Fortunately, such injuries are relatively rare, representing less than 1% of cases reported in a single tertiary care trauma center, though many such cases are associated with facial, spinal, or intracranial trauma [4]. Amongst patients presenting with traumatic injuries, those with airway injuries are more likely to be male, younger in age, and have penetrating injuries [5]. Iatrogenic injuries represent another potential source of tracheobronchial injuries. While rare in the setting of elective intubations, airway injuries may complicate up to 15% of emergent tracheal intubations [6].

The burden of airway injuries also adds significantly to morbidity, mortality, and healthcare expenditures in the United States and around the world. Traumatic injuries, including airway trauma, account for more than 27 million emergency room visits per year and are some of the most common causes of death across all age groups, resulting in over 170,000 deaths annually. The economic impact is similarly high. In 2019, the financial burden of traumatic injuries included $327 billion of direct medical care, $69 billion in lost productivity, and $3.8 trillion dollars in quality-of-life reductions [7].

Such staggering statistics highlight the need for optimal practices in traumatic airway management as such patients are challenging from both a medical and systems-based perspective. They may present with difficult airways, coagulopathy, hypothermia, significant blood loss, and injuries to other organs. Optimal management requires the involvement

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Published online: 22 August 2024

of a multi-disciplinary group of experts in trauma resuscitation, airway management, trauma surgery, and intensive care management. Ancillary teams including respiratory therapists experienced with difficult airways, trauma or critical care nurses, and clinical pharmacists all play a vital role in the initial management and stabilization of these patients. Here we review the challenges associated with patients with airway trauma and discuss management options.

Trauma and Difficult Airway

Airway trauma is a significant risk factor for difficult airway, though there is no universally accepted definition of what constitutes a difficult airway. Previously suggested descriptions of the anatomically difficult airway include difficulty with or failure of facemask ventilation, supraglottic airway ventilation, laryngoscopy, endotracheal intubation, extubation, or surgical airway by an experienced physician [8]. Commonly used methods of predicting a difficult anatomic airway include parameters such as the Mallampati score, inter-incisor distance, or thyromental distance. More recently, composite measures such as the Wilson Score have been validated as predictive of airway difficulty [9]. However, airway trauma often results in significant distortions to the normal anatomy, requiring an individualized approach to assessment and securement of the airway [10]. Also, it is important to suspect an airway injury and be prepared for difficulty even if the "traditional" predictors of difficult airway are absent.

Even in patients whose airways are anatomically normal, cardiopulmonary alterations may complicate airway management. These patients tend to have a "physiologically difficult" airway, wherein the physiologic perturbations predispose patients to a higher risk of complications during airway management [11]. Commonly encountered derangements in patients with traumatic injuries include increased transpulmonary pressure, reduced functional residual capacity, reduced diffusion capacity, cardiogenic, obstructive, and hypovolemic shock. These may be the result of pneumothorax, hemothorax, flail chest, cardiac tamponade, fat embolism syndrome, abdominal compartment syndrome, aspiration pneumonitis, or inhalational burn injuries. Such patients often have little cardiopulmonary reserve, decompensate quickly upon induction of anesthesia, and are at high risk for aspiration in the setting of abdominal trauma and unknown fasting status. Patients presenting with a combination of anatomically and physiologically difficult airways present additional challenges, as physiologic decompensation may leave little time to identify a traumatized airway.

Prehospital Management

Primary Airway Assessment

Initial evaluation of patients suffering airway trauma often begins in the field. Multiple predictive tools have been developed and validated for rapid airway evaluation, commonly used examples include the Mallampati score, and the LEMON, MOANS, and 3–3-2 systems [12]. (Table 1) The HEAVEN criteria were recently published by Davis et al. which also accounts for non-anatomic features to help predict both an anatomically as well as physiologically difficult airway [13]. However, these systems are often inadequate in the setting of airway trauma as they may not adequately account for significant distortions of the airway not readily identifiable on preliminary examination.

Non-Invasive Respiratory Support

Tracheal intubation is not always possible in the prehospital setting. Insufficient equipment, lack of appropriately trained personnel, and environmental challenges such as weather, traffic, or topography all contribute to the challenge of managing a traumatic airway in the field [14]. The choice between temporizing at the scene versus definitive airway management is guided by triage, availability of expertise and equipment in the pre-hospital setting, and travel time to the hospital. Airway management in these circumstances is also impacted by associated injuries to other organs and the overall condition of the patient. In the absence of a secure

Table 1 Various scores for airway evaluation

HEAVEN	LEMON	MOANS	Mallampati
Hypoxemia	**L**ook externally	**M**ask seal	I – all of the soft palate
Extreme of size	**E**valuate 3–3-2*	**O**bstruction or obesity	II – all of the uvula
Anatomically difficult	**M**allampati ≥ 3	**A**ge > 55	III – base of uvula only
Vomit/blood/fluid	**O**bstruction	**N**o teeth	IV – hard palate only
Exsanguination	**N**eck immobility	**S**tiff lungs	
Neck immobility			

*3–3-2: Incisor distance 3 fingerbreadths, hyoid-mental distance 3 fingerbreadths, thyromental distance 2 fingerbreadths airway, first responders may provide oxygen support via non-invasive means such as facemask, nasal cannula, or bag valve mask. Ideally, this is done with maintenance of spontaneous respirations and minimal use of sedating medications [15].

Hemodynamic Stabilization

Stabilization of hemodynamics, if time permits, offers another important avenue for optimization prior to airway management to avoid peri-intubation cardiovascular complications. Patients suffering airway trauma are particularly susceptible to hemodynamic deterioration during prolonged or multiple intubation attempts [16]. Appropriate resuscitation during the prehospital period improves tolerance to anesthetic induction and successful airway intervention [17].

Airway Management

Evaluation of a Traumatized Airway

Airway trauma may not be readily apparent, and its evaluation requires a high level of suspicion. Airway examination should be as complete as possible, and as mentioned above, tools have been developed and validated for rapid airway evaluation. However, lack of time and patient cooperation, neck immobilization, and injury in and around the airway may preclude such assessment. History and physical examination can help determine the mechanism of injury, extent of associated injuries, as well as the degree of hemodynamic compromise. In cases where the airway compromise is due to tissue disruption, edema and hematoma may worsen over time. Regular evaluation of the airway and early intervention to secure the airway prior to airway compromise may be needed in such cases. If there is concern that the airway may worsen over time, early airway management should be considered before it becomes emergent. This is especially true for chemical ingestion or burns.

General Approach

There is limited evidence regarding the management of patients with a traumatized airway. Initial management includes basic maneuvers such as administration of 100% oxygen, suction, chin lift, jaw thrust, oral airway, and bag-mask ventilation. If a cervical injury is suspected, due caution should be exercised (e.g., manual in-line immobilization, cervical collar). Nasal airways should be avoided if there is a possibility of base of skull or nasal fracture. Patients with limited airway injury may not require tracheal intubation, but in one study, tracheal intubation was emergently required in approximately 50% of the penetrating trauma cases and 80% of blunt trauma cases [1]. Patients with severe trauma, cardiac arrest, shock, respiratory distress, hypoxia, severe agitation, and inability to protect the airway, i.e., low Glasgow Coma Scale score (≤ 8) and altered mental status, should have their airway secured urgently [18]. Esophageal injury is common in patients with laryngo-tracheal trauma, and these patients should be intubated urgently [1]. Early securing of the airway should also be considered in patients with hematoma in or around the airway, or injury due to chemical, biological, or inhalational agents, including smoke and burns that cause mucosal edema. The decision between establishing a primary surgical airway, awake/spontaneous breathing intubation, rapid sequence intubation (RSI), and watchful waiting without intubation depends on the patient's clinical condition, including the type and severity of airway and systemic injuries, as well as logistical considerations, including available personnel, equipment, and expertise. Various techniques of tracheal intubation including direct laryngoscopy (DL), video laryngoscopy (VL), or flexible bronchoscopy (FOB) may be used.

Direct Versus Video Laryngoscopy

The 2012 Eastern Association for the Surgery of Trauma Practice Management Guidelines recommends tracheal intubation using DL as the technique of choice for securing the airway in trauma patients [19]. However, because of the heterogeneity in the presentation of patients with traumatic airways, this recommendation may not be generalizable for all situations. VL has emerged as an alternative technique to traditional direct laryngoscopy and provides certain advantages. VL provides the ability to view the laryngeal inlet without aligning the oral, pharyngeal, and laryngeal axes, and thus may be beneficial in patients with traumatic injuries that limit this alignment [20]. VL use has been associated with improved first-attempt intubation success and glottic views as compared to DL [21, 22]. Furthermore, it has been suggested that the use of a hyperangulated VL blade may reduce rates of accidental esophageal intubation [23]. Also, VL may result in less movement of the cervical spine as compared to DL [24, 25]. This characteristic makes video laryngoscopy an attractive option in patients with associated cervical spine injuries or if manual in-line stabilization is being used. While both DL and VL are associated with movement of the cervical spine, the use of video laryngoscopy reduces the incidence of failed intubation in the setting of manual in-line stabilization [25]. Although a recent study reported higher incidence of successful intubation on the first attempt with the use of VL versus DL for tracheal intubation in critically ill patients, the universal use of VL as the first choice in patients with traumatic injuries needs further evaluation [21].

Because video laryngoscopes depend on a functional optical device with an unobstructed field of view, there is a risk of the lens being obscured by blood, secretions, or other foreign bodies, especially in the setting of a traumatic airway. Suction Assisted Laryngoscopy and Airway Decontamination (SALAD) is a technique that involves advancement of a rigid, curved suction catheter into the oropharynx directly ahead of a laryngoscope to continuously clear blood and secretions [20, 26]. SALAD may be especially useful during intubation attempts using video laryngoscopy in the setting of a massively contaminated airway. Large randomized controlled trials are needed to establish the role of SALAD in the setting of airway trauma.

Flexible Bronchoscopy (FOB)

FOB allows for identification of the site, depth, and extension of the airway injury and placement of the endotracheal tube distal to the site of injury under direct visualization [27]. Awake FOB-guided intubation is the recommended airway management technique in cases of distorted neck anatomy or suspected laryngotracheal or tracheobronchial injury [28, 29]. FOB is also preferable if airway access is limited as in the prone or lateral position or in the presence of a surgical halo device for neurosurgical fixation. However, FOB may be difficult in the setting of maxillofacial trauma with blood present in the airway that may obscure visualization of airway structures [30]. The use of FOB is also limited by the presence of secretions, and the inability to displace debris.

Awake Intubation Versus Rapid Sequence Intubation

Intubation in a spontaneously breathing or "awake" patient affords more time for intubation before oxygen desaturation (if adequate preoxygenation has occurred), allows more complete inspection of the airway, and can avoid the potential deleterious effects of bag-mask valve (BMV) ventilation. If not initiated below the level of airway injury, positive pressure ventilation can lead to the development of subcutaneous emphysema, progressive distortion of airway anatomy, and life-threating airway obstruction [28, 29]. Furthermore, positive pressure ventilation can have significant hemodynamic effects. The application of positive pressure ventilation increases intrathoracic pressure, which may impair venous return and cardiac output. The magnitude of this response can be substantial in patients who are hypovolemic or have underlying cardiac comorbidities [31]. Awake intubation, however, requires time to perform, a degree of patient co-operation, and also requires for patients to be hemodynamically stable and be able to protect their airway. Many patients with traumatic injuries are intoxicated or have altered mental status due to head trauma, thus limiting the use of this technique. Topicalization of the airway with local anesthesia is mandatory to facilitate patient tolerance but may be challenging in the setting of a swollen or bleeding airway. In addition, airway nerve blocks may be contraindicated, or difficult to perform in these settings. Administration of intravenous sedation should be minimized or avoided altogether as this can cause hypotension, hypoventilation, and oversedation, which may also potentially cause or worsen airway obstruction, especially in the presence of airway edema. On the other hand, rapid sequence intubation (RSI) is usually faster and more suitable for uncooperative patients. Also, the equipment and personnel to perform RSI is generally more readily available in all locations. For non-cooperative patients requiring preoxygenation, delayed sequence intubation (DSI) can provide an alternative technique to optimize intubating conditions. First described by Weingart in 2010, DSI consists of the administration of sedatives that maintain spontaneous respiration during the provision of supplemental oxygenation prior to neuromuscular blockade and intubation [32].

The decision to administer neuromuscular blockade in the setting of a traumatic airway is complex. In certain scenarios, neuromuscular blockade can lead to complete airway obstruction from the loss of airway muscle tone [27, 29]. Furthermore, because advancement of the endotracheal tube beyond the level of the vocal cords is not done under direct visualization, intubation using a rapid-sequence technique risks worsening an underlying airway injury or creating a false extra-tracheal passage [28]. If safe from an anatomical perspective, the use of a neuromuscular blocking agent may improve intubation first-pass success versus intubation attempts without neuromuscular blocking agents [33].

Combined VL and FOB

If multiple experienced providers are available to assist with airway management, the concomitant use of FOB with VL will allow for visualization both above and below the vocal cords during intubation attempts. This may be an especially useful technique in cases of penetrating neck injury with injuries at multiple places in the airway. With this method, the video laryngoscope can provide an excellent view of the supraglottic structures and glottic opening while also creating physical space for advancement of the bronchoscope. Once an adequate view is obtained by VL, a FOB with a preloaded endotracheal tube (preferably smaller sized) can be carefully passed through the vocal cords under visualization provided by the video laryngoscope. Once the bronchoscope is advanced into the trachea and its presence confirmed by visualization of tracheal rings, the preloaded endotracheal tube can be slid-off and the bronchoscope safely removed.

Pharmacologic Agents

Induction Agents

There is no single best induction agent for patients presenting with a traumatized airway. Commonly used agents include propofol, etomidate, and ketamine. Propofol is a short-acting intravenous sedative-hypnotic that is commonly used for procedural sedation and general anesthesia [34]. Propofol administration causes both peripheral vasodilation and impaired myocardial contractility. These effects may predispose patients to profound hypotension, especially in the setting of trauma or hypovolemia [35, 36]. Like propofol, etomidate is also a short-acting intravenous sedative-hypnotic and is widely used for airway management in the emergency department setting [37]. Etomidate has minimal impact on the cardiovascular system and thus represents an excellent option in patients who are hemodynamically unstable [38]. It does cause dose-dependent inhibition of 11β-hydroxylase, an important enzyme for steroidogenesis, and as a result, etomidate administration has been associated with adrenocortical axis suppression [38]. Ketamine is a powerful analgesic, sedative, and dissociative agent that preserves spontaneous respirations and maintains the protective airway reflexes [39]. Ketamine administration is associated with increases in cardiac output, heart rate, and blood pressure, which may make it an attractive choice in patients who are hypotensive. Finally, ketamine may also have a role in patients who are critically injured, agitated, and delirious and thus will not tolerate preoxygenation prior to any intubation attempts. In this scenario, administration of intravenous ketamine (administered in 0.5 mg/kg increments) may be used to achieve tolerance with preoxygenation efforts while maintaining spontaneous ventilation [40].

Despite these data, there is little information on the optimal regimen for induction in the patient with airway trauma. A retrospective analysis of induction agents used in trauma patients undergoing RSI by Kuza et al. showed that etomidate was associated with higher mortality and complications rates than propofol [41]. Whereas a retrospective multicenter analysis of trauma patients undergoing RSI by Gassler et al. showed no increased risk with the use of etomidate versus other induction agents including propofol and ketamine [42]. Novel agents are emerging to help address the need for more optimal induction strategies. "Ketofol" is a premixed combination of propofol and ketamine [43]. It has been shown in some studies to have improved hemodynamics compared to standard induction agents, while others have shown no superiority [44, 45].

Neuromuscular Blocking Agents

Succinylcholine and rocuronium are the most commonly used neuromuscular blocking agents in patients with traumatic injuries [46]. Succinylcholine is a depolarizing neuromuscular blocker and provides a rapid onset with a short duration of action. The administration of succinylcholine is contraindicated in patients with known decreased plasma cholinesterase activity, recent burns or trauma within 24 to 72 h, and muscle myopathies. Rocuronium is a non-depolarizing neuromuscular blocker, and does not have significant contraindications, but does have a longer onset and duration of action. A 2015 Cochrane Database Systematic Review by Tran et al. concluded that succinylcholine created better intubating conditions than rocuronium during rapid-sequence induction [47]. Recently, a large randomized controlled trial found that among adults undergoing tracheal intubation in an emergency setting, rocuronium was non-inferior to succinylcholine with regards to first pass success without major complications [48]. Rocuronium can be an alternative in case of contra-indications to succinylcholine.

Oxygen Therapy

Continuous delivery of oxygen throughout airway evaluation, induction, and intubation is crucial to preventing desaturation in the setting of airway trauma and is recommended by the most up to date American Society of Anesthesiologists (ASA) Practice Guidelines for the Management of the Difficult Airway [8]. Conventional preoxygenation involves use of a tight-fitting facemask to target an end-tidal oxygen (EtO2) of 90% or greater [49]. This method is often limited by improper mask fit, insufficient time, or poor physiological reserve, and frequently fails to achieve EtO2 targets [50]. Face masks face the additional limitation of requiring removal during intubation attempts, causing loss of positive pressure and de-recruitment of alveoli.

More recently, high-flow nasal oxygenation (HFNO) is being used as both primary and supplemental oxygen support in the peri-intubation period. These systems are able to deliver fraction of inspired oxygen (FiO2) of up to 100%, flows up to 60L/min, and low levels of positive end-expiratory pressure (PEEP) [51]. These allow HFNO to provide a "stenting" effect for obstructed airways with the added benefit of allowing continuous oxygen support, including during intubation attempts. A large, prospective, multicenter trial showed that addition of HFNO to facemask oxygen results in improved EtO2 and SpO2 during apneic oxygenation [52]. Despite these benefits, HFNO, should be used cautiously in patients with known or suspected craniofacial trauma or anatomic disruption of the airway as there is a high risk of exacerbating such injuries or causing subcutaneous emphysema [53]. Also, in situations where a face mask cannot be applied for pre-oxygenation due to traumatic injuries, HFNO might be the only effective way to deliver oxygen. Continuous positive airway pressure (CPAP) via tight-fitting facemask also allows delivery of 100% FiO_2 with significant positive pressure support. However, this is contraindicated in patients at high aspiration risk and must be removed to facilitate intubation, thus is unlikely to provide superior outcomes [54]. In the setting of significant facial trauma, placement of face masks and even HFNO might be challenging/impossible, and in these situations the use of other devices such as face tent masks for delivery of oxygen may be considered.

Rescue Techniques

Supraglottic Airways

There is a limited role for the use of supraglottic airways in the setting of airway trauma. They should only be used for rescue oxygenation in cannot-intubate, cannot-ventilate situations or as a channel for bronchoscopy-guided intubations [28]. As these devices are not placed directly into the tracheal-bronchial tree with an inflated cuff, they do not represent a secure airway. Application of positive pressure ventilation through a supraglottic airway can worsen underlying airway injuries. Supraglottic airways can also exert pressure on the posterior airway, potentially exacerbating cervical spine injuries [46]. Finally, the presence of a supraglottic airway does not protect the patient from pulmonary aspiration, further limiting their use in patients with unclear fasting status [36].

Cricothyrotomy or Surgical Airway

A surgical airway is indicated for patients with distorted upper airway anatomy, in cases of multiple failed intubation attempts, or when the injury or swelling is at the level of the glottis [55]. There are some scenarios where a cricothyrotomy should be performed much earlier in the airway management algorithm. For example, if there is expected difficulty with tracheal intubation in the setting of significant distortion of normal neck anatomy, it may be reasonable to attempt cricothyroidotomy prior to any attempts to place an endotracheal tube [29]. These cases may include patients presenting with significant laryngotracheal injuries with impending airway obstruction, massive bleeding that obscures glottic visualization, or gaping injuries to the trachea or larynx [27].

Cricothyrotomy should be avoided in thyroid and cricoid cartilage fractures. In these scenarios, awake low tracheostomy may represent the only option to safely secure the patient's airway. Tracheostomy should also be considered in the setting of an anterior neck hematoma or in cases of tracheal transection. Overall, any surgical airway should be performed below the level of the injury.

Since delayed cricothyrotomy in the setting of trauma is associated with several adverse events, including severe hypoxia and cardiopulmonary arrest, performance of early cricothyrotomy may represent the best course of action in select patients. Using data from the Trauma Quality Improvement Program database, Londoño et al. developed and validated a novel Cricothyrotomy After Trauma (CAT) score to predict the need for cricothyrotomy within one-hour of arrival in patients presenting with trauma. Higher CAT scores were associated with higher rates of emergent cricothyrotomy. Specifically, the rate of emergent cricothyrotomy was 9.3% in patients with a CAT score of 8 [56]. Elements of the CAT score include male gender, presence of pre-injury mental/personality disorder, presence of pre-injury cerebrovascular accident, penetrating trauma, admission systolic blood pressure < 90 mmHg, admission heart rate > 120 beats/min, and the presence of severe injury of the head, face, or neck.

Similarly, using data from the national trauma registry in Japan, Hayashida et al. developed and validated the Quick Surgical Airway Assessment for Trauma (qSAT) score to predict the need for a surgical airway in trauma patients [57]. The proportion of patients with a surgical airway increased with increasing qSAT score, and a qSAT score of 3 was associated with the need for a surgical airway in 25% of patients. The qSAT score is calculated as the sum of three binary elements: sex (female, 0 points; male, 1 point), presence of moderate-to-critical facial injury (no, 0 points; yes, 1 point), and presence of moderate-to-critical cervical area injury (no, 0 points; yes, 1 point).

Extracorporeal Membrane Oxygenation

Extracorporeal membrane oxygenation (ECMO) is temporary circulatory support for patients with cardiovascular and/or respiratory failure. Most commonly, veno-arterial (VA) ECMO is initiated for life-threatening cardiovascular failure while veno-veno (VV) ECMO is initiated for life-threatening respiratory failure [58]. ECMO indications relevant to the traumatic airway setting include life-threatening airway obstruction, pulmonary contusion, and pulmonary hemorrhage. Additionally, ECMO may be required during cases of intrathoracic airway trauma. ECMO is highly invasive, time-consuming to initiate, requires a trained team to implement and necessitates systemic anticoagulation. Because of these features, it should be reserved for life-threatening cardiovascular and/or respiratory failure when all other management strategies have been exhausted. A general treatment algorithm for managing the patient with a traumatized airway is proposed in Fig. 1.

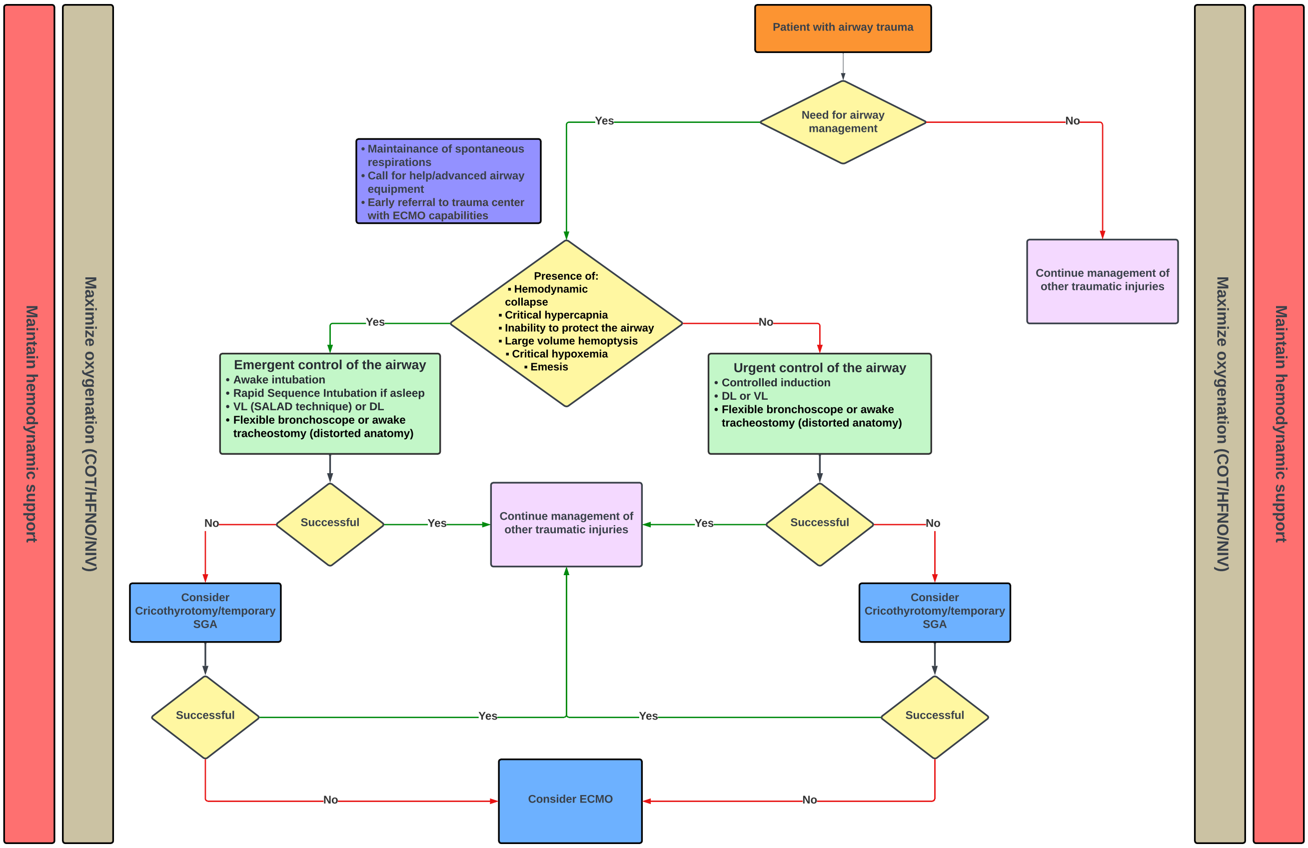

Fig. 1 Proposed algorithm for managing a patient with traumatized airway. VL, video-laryngoscopy; DL, direct-laryngoscopy; SALAD, Suction Assisted Laryngoscopy and Airway Decontamination; SGA, supraglottic airway; ECMO, extra-corporeal membrane oxygenation; COT, conventional oxygen therapy; HFNO, high flow nasal oxygenation; NIV, non-invasive ventilation

Areas for Future Research

There continue to be many unknowns in this subject, and many unanswered questions. Studies describing ways to reduce hypoxemia and hypotension in the prehospital setting will help bridge a gap during the critical period between injury occurrence and arrival at a treatment center [59]. Risk stratification tools continue to develop as we better understand the role of early intubation and surgical airway management. The applicability of artificial intelligence (AI) systems and a deep neural network approach for prediction of unplanned intubation in the prehospital setting was recently demonstrated [60], and further research on the role of AI in predicting the need for tracheal intubation in patients with airway trauma is needed. The optimal drugs for induction and maintenance of anesthesia in patients with traumatic airway injuries remains an active area of investigation [61]. Remimazolam, a short acting benzodiazepine which has shown potential for brief periods of sedation with the ability to quickly regain spontaneous respirations [62], needs further evaluation in the management of a physiologically difficult airway. Recent studies have shown the ability of novel potassium channel blockers to reverse propofol-induced respiratory depression, indicating another avenue for brief, easily reversible sedation during multiple intubation attempts [63].

Conclusion

Airway trauma is a rare but dangerous complication in patients suffering blunt or penetrating trauma. Identification and classification of airway trauma remains a challenge, and a high level of suspicion is warranted even in patients with seemingly normal surface anatomy at the time of presentation. Hemodynamic support, non-invasive oxygenation, and maintenance of spontaneous respirations are important prior to definitive airway control. Early referral to a center experienced in trauma care, complex airway management, and with ECMO capabilities offers the highest likelihood of survival. The standard techniques of laryngoscopy, bronchoscopy, and surgical airway control are essential in this patient population but may prove deceptively difficult with significant distortions of normal anatomy.

Author Contributions S.D. and B.R. wrote the initial draft and constructed the initial tables/figure. K.K. edited the manuscript and the tables/figures.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Conflict of Interests The authors declare no competing interests.

Human and Animal Rights This article does not contain any studies with human or animal subjects performed by any of the authors.

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