

# FAILED AIRWAY IN UPPER AIRWAY TRAUMA PATIENTS

BILJANA SHIRGOSKA<sup>1</sup>, JANE NETKOVSKI<sup>2</sup> and IGOR KIKERKOV<sup>3</sup>

*<sup>1</sup>University of Skopje, University Department of Otorhinolaryngology, Anesthesiology Department, Skopje, <sup>2</sup>University of Skopje, Medical Faculty, University Department of Otorhinolaryngology, ENT Department, Skopje and <sup>3</sup>University of Skopje, Medical Faculty, Department of Preclinical and Clinical Pharmacology with Toxicology, Skopje, R. Macedonia*

Upper airway trauma patients have to be treated as difficult airway patients in pre-hospital and hospital settings. Airway management is included in the prehospital trauma care and advanced trauma care. The aim of this article is to present clinical observations that pertain to airway management in upper airway trauma patients, including clinical approach to traumatized upper airway, difficulties in airway management in these patients, definition of failed airway, algorithm for failed airway, anticipation and decision-making. Clinical approach to upper airway is the first step that clinicians usually do. Traumatized airway is by the book difficult airway that does not need the same procedure of prediction that we use evaluating the airway. Difficulties in airway management in trauma patients include difficulties in laryngoscopy and intubation, difficult bag-mask ventilation and difficulties in the use of supraglottic devices. In the severely upper airway traumatized patients, a clear definition of airway failure is necessary, as well as an action plan to follow when this occurs. According to Difficult Airway Society guidelines for management of unanticipated difficult intubation in adults, failed airway exists when there have been three failed attempts by an experienced anesthetist, or there has been one failed attempt by an experienced anesthetist combined with inability to maintain adequate oxygen saturation. Repeated attempts of intubation carry the risk of traumatizing the already traumatized upper airway. The time and ability to think clearly are limited in this situation, so airway algorithm can be used in these situations. On the other hand, there are many failed airway algorithms developed by the societies. The most important points in those algorithms are anticipation and decision-making, decision driven by whether there is sufficient time to consider alternatives. If 'cannot intubate, cannot oxygenate' scenario arises, the pathway leads to the front open neck access (FONA). It is perfectly appropriate to attempt rapid placement of laryngeal mask airway (LMA) simultaneously with preparation for FONA. The attempt of LMA placement must not delay the initiation of the definitive airway and must be accomplished in parallel with the preparations for FONA. Reasons for difficult FONA can be penetrating or blunt neck trauma. Trauma-related difficulty in these situations is distorted or disrupted airway. Cricothyroid membrane could be accessible or injured. Low tracheotomy is a solution for airway establishing in this situation.

**KEY WORDS:** failed airway, upper airway trauma patients

**ADDRESS FOR CORRESPONDENCE:** Biljana Shirgoska, MD, PhD  
E-mail: bshirgoska@yahoo.com  
Tel: +38975268760

## INTRODUCTION

Upper airway trauma patients have to be treated as difficult airway patients in pre-hospital and hospital settings. The best strategy for trauma patients is to provide immediate trauma care. Airway management is included in the pre-hospital trauma care and advanced trauma care within the first hour of trauma called the golden hour (1,2).

The aim of this article is to present clinical observations that pertain to airway management in upper airway trauma patients, including: (a) clinical approach to traumatized upper airway, (b) difficulties in airway management in upper airway trauma patients, (c) definition of failed airway, and (d) algorithm for failed airway, anticipation and decision-making.

### **(a) Clinical approach to upper airway trauma patients**

Upper airway trauma patients are urgent patients that enter through the emergency department to our ENT Surgery Department. We have a standby airway team, an airway surgeon and an anesthetist. A systematic well-established department plan should be followed for treatment of these patients.

Clinical approach to upper airway is the first step that clinicians usually do. Traumatized airway is by the book a difficult airway. Upper airway trauma patients are more difficult for face mask ventilation, laryngoscopy and intubation than other patients. Herein, we discuss the reasons for these difficulties from the clinical point of view.

Face mask ventilation is the first problem in upper airway trauma patients. The reasons for difficult face mask ventilation are facial injuries with swelling, airway disruption or distortion. Displacement of laryngo-tracheal fracture, tracheal edema and surrounding tissue hematoma make the oxygenation during face mask ventilation insufficient. Facial edema, hematoma and burns could be the reasons for insufficient face mask ventilation, too.

Pharyngeal airway placed into the mouth or nasopharyngeal airway may maintain airway patency during face mask ventilation. Subsequent assisted ventilation may be more successful if separate rescuers apply the jaw thrust, hold the face mask with both hands, and squeeze the reservoir bag (3).

Laryngoscopy in trauma patients is the second problem that the airway specialist is faced with. It becomes more difficult in the presence of upper airway edema, blood, burns or other things that obstruct the upper airway.

Undesirable situation that impacts the upper airway is head injury with impaired consciousness and reduced pharyngeal tone. The airway may also be soiled with blood or regurgitated matter. Significant partial and incipient airway obstruction are the potential causes of early death.

### **(b) Difficulties in airway management in upper airway trauma patients**

Difficulties in airway management in upper airway trauma patients are difficulties in laryngoscopy and intubation, difficulties in supraglottic airway devices use and difficult ventilation. Patients with limited head and neck movement from trauma suffer a higher incidence of intubation difficulty.

In the study by Gambling *et al.*, 83 trauma patients were studied for difficult direct laryngoscopy. All trauma patients requiring emergency tracheal intubation were evaluated prospectively for laryngoscopy view (grade 1-4), ease of intubation, number of attempts, and incidence of failed intubation. The authors concluded that there was one failed intubation in an unresponsive patient with grade 4 laryngeal view. One head injured patient required 3 attempts at laryngoscopy due to a large epiglottis and pulmonary edema obscuring the view (4).

The reasons for difficult laryngoscopy and intubation in trauma patients are limited mouth opening or jaw displacement and inability to position the airway.

Anesthesiologic approach to manage the difficult traumatized airway is oxygenation in the first place, external laryngeal manipulation if it is possible, and gum elastic boogie use for tracheal intubation. The use of conventional or video laryngoscopy depends on the anesthetist's skills.

Oxygen can be delivered by oxygen supply nasal cannula with 10 L/min flow. Oxygen supply is mandatory to maintain adequate oxygen saturation of the tissue throughout the procedure of establishing the airway.

Gum elastic boogie, an endotracheal tube introducer, is a very useful device. Its advantage lies not only in making difficult intubation possible when only a portion of laryngeal inlet or epiglottis alone is visualized. Its use is not affected by the presence of blood and secretion (5).

Anesthesiologic approach to bloody difficult airway combined with or without vomiting is suction-assisted laryngoscopy airway decontamination (SALAD) (6).

Rapid sequence induction and tracheal intubation under anesthetics, sedative and neuromuscular blocking drug in upper airway trauma patients are still considered hazardous. The pressure over a fractured cricoid may dislocate it enough to completely distort the upper airway, change the view of the physician performing the intubation, or even lead to complete airway transection and obstruction (7).

Intravenous induction and neuromuscular blockade should be avoided since apnea and loss of the smooth muscle tone may lead to complete collapse of an already traumatized and distorted airway kept functional by the surrounding musculature. Therefore, spontaneous breathing of the patient should be preferred until safe airway has been achieved. Disrupted or distorted airway has to be treated with awake intubation.

Anesthesiologic approach to manage difficult oxygenation in upper airway trauma patient is supraglottic

device placement. This device cannot be used in the presence of supraglottic trauma injuries of the patient's airway.

A failure to oxygenate the patient by a face mask or oxygenate and ventilate by a supraglottic airway device occurring in conjunction with failed tracheal intubation defines failed oxygenation, 'cannot intubate, cannot oxygenate' (CICO) situation (8).

### **(c) Definition of airway failure**

In the severely upper airway traumatized patients, a clear definition of airway failure is necessary, as well as an action plan to follow when this occurs. We comply with the Difficult Airway Society (DAS) guidelines for the management of unanticipated difficult intubation in adults. Failed airway exists when there have been three failed attempts by an experienced anesthetist, or there has been one failed attempt by an experienced anesthetist combined with inability to maintain adequate oxygen saturation (9,10).

Practical guidelines and strategy for difficult airway intubation are also recommended by the American Society of Anesthesiologists (11).

### **(d) Algorithm for failed airway, anticipation and decision-making**

Repeated attempts of intubation carry the risk of traumatizing the already traumatized upper airway. The time and ability to think clearly are limited in this situation; hence, it is useful to follow an airway algorithm. We follow DAS algorithm for the management of unanticipated difficult intubation in adults.

In 2015, the DAS Intubation Guidelines Working Group published guidelines for the management of unanticipated difficult intubation in adults. They recommend that if tracheal intubation fails, supraglottic airway devices are to be used in order to provide a route for oxygenation while reviewing how to proceed. The second-generation supraglottic airway devices have advantages over the first generation and they are recommended in these situations. When both tracheal intubation and supraglottic airway device insertion have failed, waking the patient is the default option. If at this stage, facemask oxygenation is impossible in the presence of muscle relaxation, cricothyroidotomy should follow immediately. Scalpel cricothyroidotomy is recommended as the preferred rescue technique and should be practiced by all anesthetists. The plans outlined are designed to be simple and easy to follow (10).

The Canadian Airway Focus Group (CAFG) studied the unanticipated difficult airway and made recom-

mendations on the management in a 1998 publication. The CAFG has since reconvened to examine more recent scientific literature on airway management. The Focus Group's mandate for this article was to arrive at updated practice recommendations for the management of the unconscious/induced patient in whom difficult or failed tracheal intubation is encountered.

They suggest that the clinician has to be aware of the potential harm to the patient that can occur with multiple attempts at tracheal intubation. This likelihood can be minimized by moving early from an unsuccessful primary intubation technique to an alternative 'Plan B' technique if oxygenation by face mask or ventilation using a supraglottic device is non-problematic. Irrespective of the technique used, failure to achieve successful tracheal intubation in a maximum of three attempts defines failed tracheal intubation and signals the need to engage an exit strategy. Failure to oxygenate by face mask or supraglottic device ventilation occurring in conjunction with failed tracheal intubation defines a failed oxygenation, 'cannot intubate, cannot oxygenate' situation. Cricothyrotomy has to be undertaken without delay, although if not already tried, an expedited and concurrent attempt can be made to place a supraglottic device (12).

They have recommended that with an appropriate airway evaluation and consideration of relevant contextual issues, a rational decision can be made on whether an awake tracheal intubation will maximize patient safety or if airway management can safely proceed after induction of general anesthesia. With predicted difficulty, close attention should be paid to details of implementing the chosen approach. This should include having a plan in case of failure of tracheal intubation or patient oxygenation (13).

On the other hand, there are many airway algorithms developed by the national societies. The most important points in those algorithms are anticipation and decision-making.

In 2015, DAS published guidelines for the management of difficult and failed tracheal intubation in obstetrics (14). They recommend FONA (front open neck access) as a solution for 'cannot intubate, cannot oxygenate' scenario (CICO). In failed oxygenation and 'cannot intubate, cannot oxygenate' situation, if oxygenation is not restored via a supraglottic airway device, immediate front open neck access should follow without further attempts with either supraglottic airway device placement or transglottic tracheal intubation – strong recommendation for level of evidence C (10).

It is perfectly appropriate to attempt rapid placement of laryngeal mask airway (LMA) simultaneously with

preparation for FONA. The attempt at placement of laryngeal mask airway must not delay the initiation of the definitive airway and must be accomplished in parallel with the preparations for the front open neck access. The reasons for difficult front open neck access can be penetrating or blunt neck trauma. Trauma-related difficulty in these situations is distorted or disrupted airway. Cricothyroid membrane may not be accessible or may be injured. Low tracheotomy is a solution for airway establishing in this situation (6,15).

## CONCLUSION

Establishing and maintaining a patent airway is the priority in upper airway trauma patients. Basic airway maneuvers will often enable sufficient oxygenation and ventilation in these patients. Induction of anesthesia, laryngoscopy and intubation of upper airway trauma patients is challenging and should be attempted only by those with appropriate training and competency.

Understanding when and why upper airway trauma patients may encounter difficulty in airway management can help guide the logistic and mental exercise of developing specific strategies and contingency planning.

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## SAŽETAK

### OZLJEDE DIŠNOG PUTA KOD TRAUME DIŠNOG PUTA

B. SHIRGOSKA<sup>1</sup>, J. NETKOVSKI<sup>2</sup> i I. KIKERKOV<sup>3</sup>

<sup>1</sup>Univerzitet u Skopju, Medicinski fakultet Skopje, Univerzitetska otorinolaringološka klinika, Odjel za anesteziju, Skopje,

<sup>2</sup>Univerzitet u Skopju, Medicinski fakultet Skopje, Univerzitetska otorinolaringološka klinika, Odjel za otorinolaringologiju, Skopje i <sup>3</sup>Univerzitet u Skopju, Medicinski fakultet, Odjel za pretkliničku i kliničku farmakologiju s toksikologijom, Skopje, R. Makedonija

Bolesnici s ozljedama gornjeg dišnog puta moraju biti tretirani kao bolesnici s teškim dišnim putem, u predbolničkom i bolničkom okruženju. Upravljanje dišnim putem uključeno je u predbolničku skrb i naprednu skrb. Cilj ovog rada je prikazati klinička opažanja koja se odnose na liječenje dišnog puta u bolesnika s ozljedama gornjeg dišnog puta, uključujući klinički pristup traumatiziranim gornjim dišnim putovima, poteškoće u uspostavljanju dišnog puta kod takvih pacijenata, definiranje neuspjelog dišnog puta, algoritam za neuspjeli dišni put, predviđanje i odlučivanje. Klinički pristup gornjem dišnom putu je prvi korak koji kliničari obično rade. Traumatizirani dišni put zahtijeva istu procjenu predviđanja teškoća pri tretmanu, koji koristimo i za procjenu netraumatiziranog dišnog puta. Teškoće u uspostavljanju dišnog puta kod bolesnika s traumom su: poteškoće u laringoskopiji i intubaciji, otežana ventilacija pomoću maske i poteškoće u upotrebi supraglotičkih uređaja. Kod pacijenata s ozbiljno traumatiziranim gornjim dišnim putem neophodna je jasna definicija zatajenja uspostavljanja dišnog puta, kao i akcijski plan koji će nakon toga slijediti. Prema smjernicama *Difficult Airway Society* za upravljanje neočekivanom teškom intubacijom kod odraslih, neuspješnom intubacijom se smatra nakon tri neuspjela pokušaja iskusnog anesteziologa ili nakon jednog neuspjelog pokušaja iskusnog anesteziologa u kombinaciji s nemogućnošću održavanja dovoljne zasićenosti kisikom. Ponovljeni pokušaji intubacije nose rizik od traumatizacije već traumatiziranog gornjeg dišnog puta. Vrijeme i sposobnost jasnog razmišljanja u ovoj situaciji ograničeni su pa se u tim situacijama treba koristiti DAS-ovim algoritmom. S druge strane, postoji puno propalih algoritama dišnog puta koje su propisala nacionalna stručna društva. Ono što je najvažnije u tim algoritmima i u svima isto, jest predviđanje i donošenje odluka. Odluke su vođene s obzirom na to ima li dovoljno vremena za razmatranje alternativa. Ako se u bilo koje vrijeme ne može intubirati i ne može dati kisik, nastaje scenarij CICO (ne može se intubirati, ne može se oksigenirati) i jedino rješenje je otvaranje prednjeg pristupa vratu (FONA). Odgovarajuće je pokušati brzo postaviti laringealnu masku (LMA) istovremeno s pripremanjem za FONA. Pokušaj postavljanja LMA ne smije odgoditi inicijaciju konačnog dišnog puta i mora se učiniti paralelno s pripremanjem za FONA. Razlozi za tešku FONA mogu biti unutarnje ili otvorene ozljede vrata. Teškoće vezane uz povredu u takvim situacijama su iskrivljeni ili poremećeni dišni put. Krikotireoidna membrana može biti dostupna ili ozlijeđena. U takvoj situaciji rješenje za uspostavu dišnog puta je traheotomija.

**KLJUČNE RIJEČI:** neuspjela intubacija, pacijenti s traumom