GLOBAL EDITION

International Trauma Life Support
for Emergency Care Providers

NINTH EDITION

Roy L. Alson, PhD, MD, FACEP, FAEMS
Kyee H. Han, MBBS, FRCS, FRCEM
John E. Campbell, MD, FACEP

Ninth Edition
Global Edition

INTERNATIONAL Trauma Life Support

for Emergency Care Providers

ROY L. ALSON, PhD, MD, FACEP, FAEMS

KYEE H. HAN, MBBS, FRCS, FRCEM

JOHN E. CAMPBELL, MD, FACEP

Pearson

Harlow, England • London • New York • Boston • San Francisco • Toronto • Sydney • Dubai • Singapore • Hong Kong
Tokyo • Seoul • Taipei • New Delhi • Cape Town • São Paulo • Mexico City • Madrid • Amsterdam • Munich • Paris • Milan

Airway Equipment

The most important rule to follow in regard to airway equipment is that it should be in good working order and immediately available. It will do the patient no good if you have to run back to the ambulance to get the suction apparatus. In other words, be prepared. This is not difficult. The following five basic pieces of equipment are necessary for the initial response to all prehospital trauma calls:

- Personal protection equipment (see Chapter 1)
- Patient transfer device (backboard or scoop)
- Appropriate-sized rigid cervical extrication collar
- Airway kit (see the following information)
- Trauma box (see Chapter 1)

Figure 6-11 An airway kit containing the essentials for airway management. Note that portable suction is included in this design. The total weight (with aluminum "D" oxygen cylinder) is approximately 10 kg (22 lb), about the same as a steel "E" cylinder.

The airway kit should be completely self-contained and should contain everything needed to secure an airway in any patient. Equipment now available is lightweight and portable. Oxygen cylinders are aluminum, and newer suction devices are less bulky and lighter. It is no longer acceptable to have suction units that are bulky and stored separately from a source of oxygen. Suction units should be contained in a kit with oxygen and other essential airway tools. A lightweight airway kit should consist of the following (Figure 6-11):

- Portable oxygen cylinder, preferably aluminum
- Portable battery-powered and hand-powered suction units
- Oxygen cannula and masks for adult and pediatric patients
- Oropharyngeal and nasopharyngeal airways
- Endotracheal intubation kit, with both adult and pediatric laryngoscope blades and ET tubes
- Gum elastic bougie
- Supraglottic airways
- Bag-valve mask ventilating device (with reservoir bag)
- Pulse oximeter
- End-tidal CO_2 monitor (preferably a waveform capnography device)
- Cricothyrotomy kit, either surgical or needle
- Video laryngoscopy system, if available

The contents of the airway kit are critical. Check all equipment each shift, and have a card attached to be initialed by the person checking it.

Case Presentation *(continued)*

You are the lead emergency care provider in an ALS ambulance transporting a seriously injured assault victim to the trauma center. The patient is unresponsive. Noting the change in mental status along with a decrease in tidal volume in your patient, you immediately have your partner set up suction and begin to assist respirations with a bag-valve mask, while preparing to perform orotracheal intubation. (If you were not trained in this procedure, you would immediately contact online medical direction for advice on the nearest facility capable of handling this problem.) You also have equipment ready for your backup airway.

Case Presentation *(continued)*

After testing your equipment, you administer DAI medications per your agency protocol. You maintain high-flow nasal oxygen while waiting for the paralytic to take effect and insert the laryngoscope, confirm the absence of a gag reflex, visualize the vocal cords, pass a bougie through the cords, and then thread the ETT down the bougie into the trachea. Then, instructing your partner to ventilate the patient, you listen with your stethoscope first over the epigastrium, where you hear no sounds, and then in the axilla where you hear good breath sounds on the left side. Causes of the diminished breath sounds on the right include possible pneumothorax from the probable rib fractures.

With the airway checked by auscultation, you confirm placement with end-tidal CO_2, secure the tube, and instruct your partner to assist ventilations with 100% oxygen at one 500 cc breath every 5–6 seconds. You check a pulse oximeter reading, and monitor blood pressure. Your goal is to provide ventilation to achieve an $etCO_2$ of 35–40 mm Hg.

You then reassess the patient, prepare to decompress the tension pneumothorax should the patient deteriorate and recontact the trauma center to update them on his status and your ETA.

Summary

Trauma patients provide a significant challenge in airway management, particularly in the prehospital environment. To be successful you must have a clear understanding of the anatomy of the airway and be proficient in techniques to open and maintain your patient's airway and support oxygenation and ventilation. You must have the correct equipment organized in a kit that is immediately available when you begin assessment of the trauma patient. To provide adequate ventilation for your patient, you must understand the concepts of tidal volume, minute volume, and lung compliance. Finally, you must become familiar with the various options for monitoring and control of the airway and develop and maintain expertise in performing them.

References and Resources

Birenbaum, A., D. Hajage, S. Roche, A. Ntouba, M. Eurin, P. Cuvillon, A. Rohn, V. Compere, D. Benhamou, M. Biais, et al. 2018. "Effect of Cricoid Pressure Compared with a Sham Procedure in the Rapid Sequence Induction of Anesthesia: The IRIS Randomized Clinical Trial." *JAMA Surgery*. doi:10.1001/jamasurg.2018.3577

Chu, D. K., L. H. Kim, P. J. Young, N. Zamiri, S. A. Almenawer, R. Jaeschke, W. Szczeklik, H. J. Schünemann, J. D. Neary, and W. Alhazzani. 2018. "Mortality and Morbidity in Acutely Ill Adults Treated With Liberal Versus Conservative Oxygen Therapy (IOTA): A Systematic Review and Meta-Analysis." *The Lancet* 391 (April): 1693–705.

Davis, D. P., J. Stem, M. J. Sise, and D. B. Hoyt. 2005. "A Follow-up Analysis of Factors Associated with Head Injury Mortality After Paramedic Rapid Sequence Intubation." *Journal of Trauma* 59, no. 2 (August): 486–90.

Frerk, C., V. Mitchell, A. F. McNarry, C. Mendonca, R. Bhagrath, A. Patel, E. P. O'Sullivan, N. M. Woodall, and I. Ahmad. 2015. "Difficult Airway Society 2015 Guidelines for Management of Unanticipated Difficult Intubation in Adults." *British Journal of Anaesthesia* 115, no. 6 (December): 827–48.

Hung, O., and M. Murphy. 2010. "Context Sensitive Airway Management." *Anesthesia and Analgesia* 110, no. 4 (April): 982–3.

Kovacs, G., and N. Sowers. 2018. "Airway Management in Trauma." *Emergency Medicine Clinics of North America* 36, no. 1 (February): 61–84.

Law, J. A. 2016. "Deficiencies in Locating the Cricothyroid Membrane by Palpation: We Can't and the Surgeons Can't, So What Now for the Emergency Surgical Airway?" *Canadian Journal of Anesthesia* 63 (July): 791–6.

Lundstrom, L. H., C. H. V. Duez, A. K. Norskov, C. V. Rosenstock, J. L. Thomsen, A. M. Moller, S. Strande, and J. Wetterslev. 2018. "Effects of Avoidance or Use of Neuromuscular Blocking Agents on Outcomes in Tracheal Intubation: A Cochrane Systematic Review." *British Journal of Anesthesia* 120, no. 6 (June): 1381–93.

Roberts, K., H. Whalley, and A. Bleetman. 2005. "The Nasopharyngeal Airway: Dispelling Myths and Establishing the Facts." *Emergency Medicine Journal* 22 (June): 394–6.

Robitaille, A., S. R. Williams, M. H. Tremblay, F. Guilbert, M. Thériault, and P. Drolet. 2008. "Cervical Spine Motion During Tracheal Intubation with Manual In-Line Stabilization: Direct Laryngoscopy Versus GlideScope Videolaryngoscopy." *Anesthesia & Analgesia*. 106, no. 3 (March): 935–41.

Smith, K. J., J. Dobranowski, G. Yip, A. Dauphin, and P. T. Choi. 2003. "Cricoid Pressure Displaces the Esophagus: An Observational Study Using Magnetic Resonance Imaging." *Anesthesiology* 99, no. 1 (July): 60–4.

Wang, H. E., R. H. Schmicker, M. R. Daya, S. W. Stephens, A. H. Idris, J. N. Carlson, M. R. Colella, H. Herren, M. Hansen, N. J. Richmond, et al. 2018. "Effect of a Strategy of Initial Laryngeal Tube Insertion vs Endotracheal Intubation on 72-Hour Survival in Adults with Out-of-Hospital Cardiac Arrest: A Randomized Clinical Trial." *Journal of the American Medical Association* 320, no. 8 (August): 769–78.

Weingart, S. 2011. "Preoxygenation, Reoxygenation and Delayed Sequence Intubation in the Emergency Department." *Journal of Emergency Medicine* 40, no. 6 (June): 661–7.

Weingart, S., and R. Levitan. 2012. "Preoxygenation and Prevention of Desaturation During Emergency Airway Management." *Annals of Emergency Medicine* 59, no. 3 (March): 165–75.

7

Airway Skills

S. Robert Seitz, MEd, RN, NRP
Bob Page, BAS, CCEMT-P, NCEE
Roy L. Alson, PhD, MD, FAEMS

(Pearson Education)

Maßnahmen zum Atemwegsmanagement
Habilidades para el Manejo de la Vía Aérea
Zbrinjavanje dišnog puta u traumi
Competências Práticas na Gestão da Via Aérea
Keterampilan Penatalaksanaan Jalan Napas
Техники обеспечения проходимости дыхательных путей
Gestion des voies aériennes en pratique

Δεξιότητες στην Διαχείριση Αεραγωγού
A légútbiztosítás gyakorlata
気道管理手技
氣道設置技巧
Vzpostavitev proste dihalne poti

Skills presented in this chapter:

- Patient positioning
- Airway suctioning
- Airway adjuncts
  - Nasopharyngeal
  - Oropharyngeal
  - Pocket mask with supplemental oxygen
  - Bag-valve mask
  - Supraglottic airway
    - King LT-D airway
    - i-gel supraglottic airway
    - Laryngeal mask airway
- Orotracheal intubation
  - Laryngoscopic
  - Using bougie
- Tube placement
  - Confirming
  - Reconfirming ET tube position
  - Confirming and monitoring ET tube placement with capnography

Objectives

Upon successful completion of this chapter, you should be able to:

1. Suction the airway.
2. Insert a nasopharyngeal and oropharyngeal airway.
3. Use the pocket mask.
4. Use the bag-valve mask.
5. Use the pulse oximeter.
6. Perform airway management utilizing supraglottic airway devices.
7. Prepare for endotracheal intubation.
8. Perform laryngoscopic orotracheal intubation.
9. Confirm placement of the endotracheal tube (ETT).
10. Use capnography to confirm placement of the ETT.
11. Secure the ETT.
12. Understand the use of medications to assist with intubation.

Chapter Overview

Loss of airway is one of the leading causes of preventable trauma death. It is imperative that emergency care providers know how to assess and manage the airway in the trauma patient. This chapter reviews the necessary skills to open and stabilize the airway of the trauma patient. It is essential that during airway management all team members communicate clearly with each other to ensure a smooth process and successful outcome. One should never be in a rush to secure an airway; finesse is often more important than force during airway procedures.

In managing the airway, emergency care providers should always plan for an alternative approach in case the current approach does not work. There are several schemes that have been developed to assist emergency care providers (ECPs) in approaching the trauma airway. ECPs should regularly practice the management of the trauma airway so that the team maintains competency and confidence.

It is essential for the ECP to watch for and prevent development of hypoxia during airway management. Hypoxia is associated with worse outcomes, especially in patients with traumatic brain injury.

Basic Airway Management

Procedures

Positioning the Patient

Maintaining spinal motion restriction (SMR) is a key component of care of the trauma patient. SMR can increase difficulty in managing and securing the airway. Removal of the cervical collar and application of manual inline stabilization can help. Intubating the patient in the supine position also presents challenges. If the patient is on an ambulance stretcher, the head of the stretcher can be angled up to better align the airway axes. As with managing the airway in obese patients, the goal is to align the external auditory meatus with the suprasternal notch (Figure 7-1).

A B

Figure 7-1 A. In the supine patient the pharyngeal axis and the tracheal access do not align. B. Positioning of patient to improve successful airway management. Align external auditory meatus with suprasternal notch, which better aligns the trachea and the pharynx. Notice that the spine remains straight as the head of the ambulance cot is raised. *(Courtesy Roy Alson, PhD, MD, FACEP, FAEMS)*

(*continued*)

Procedures *(continued)*

Suctioning the Airway

1. Attach the suction connecting tubing to the suction machine.
2. Turn the device on and test it.
3. Insert the suction tip through the nose (soft or whistle tip catheter) or mouth (soft or rigid) without activating the suction.
4. Activate the suction and withdraw the suction tube.
5. Repeat the procedure as necessary.

Note that although the intent is to suction foreign matter (Figure 7-2), air and oxygen also are being suctioned out of the patient. Never suction for greater than 15 seconds. After suctioning, reoxygenate the patient as soon as possible.

Figure 7-2 Suctioning material from the oropharynx using a Yankauer suction tip.

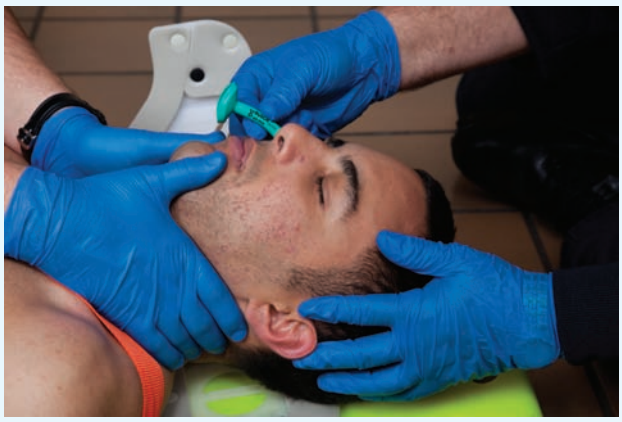
Inserting the Nasopharyngeal Airway

The nasopharyngeal airway (NPA) is designed to go into the right nostril. Consider using an alternative to the NPA if the patient has facial fractures or raccoon eyes; however, brain injury or facial fractures are not an absolute contraindication to use the NPA. To insert the NPA into the patient's right nostril, follow these steps:

1. Choose the appropriate size. It should be as large as possible but still fit easily through the patient's external nares. The size of the patient's little finger can be used as a rough guide (Figure 7-3).
2. Measure the NPA from the nares to the tip of the earlobe to ensure it is the correct length.
3. Lubricate the tube with a water-based lubricant.
4. Insert the tube straight back through the right nostril along the floor of the nose with the beveled edge of the airway toward the septum.
5. Gently pass it into the posterior pharynx with a slight rotating motion until the flange rests against the nares.

Note that if resistance to passage of the NPA is felt, *do not force* the NPA in, as injury may occur.

A



B

Figure 7-3 The nasopharyngeal airway should be the largest size that will easily fit through the external nares. *(Photos courtesy of Lewis B. Mallory, MBA, REMT-P)*