REACH℠ Air Medical Services

Above & Beyond

CASE STUDY:
AIRWAY MANAGEMENT FOR THE PATIENT WITH FACIAL INSTABILITY

One in a series of case studies developed to stimulate enhancement of problem-solving techniques for physicians, nurses and paramedics. This case study is a composite developed from a number of patient transfers performed by REACH Air Ambulance.

This Case Study is provider approved by the California Board of Registered Nursing, provider number 9697, for 1.0 contact hour. This course has been approved for one hour of category one EMT-P continuing education by California EMT-P provider number 49-0008.

LEARNING OBJECTIVES

- To describe a variety of modalities for airway management.
- To list methods of BLS, ALS and chemically facilitated airway management.
- To describe the risks and benefits of the various airway management techniques.
- To develop a personal airway management philosophy consistent with your experience, training and practice.

CASE PRESENTATION

At approximately 0200 hours, the REACH crew responded to the scene of a single car motor vehicle accident. The car had "center punched" a tree at a high rate of speed, and then rolled many times.

The patient was the unrestrained driver of the vehicle, who had undergone a prolonged extrication. He was initially contacted by the REACH crew in the back of an ambulance on a backboard in C-spine precautions under the care of the first responder paramedics. He was described as having massive fractures and complex lacerations of the face resulting in significant deformity and instability of the face and jaw. The patient had been wearing dentures which had been broken in the accident and subsequently removed by the first responders. This added to the patient's facial instability. The neck was noted to have anterior bruising. There was concern the larynx was fractured.

Airway management at this time involved "continuous suctioning of large amounts of blood" to keep the airway clear. The victim was breathing spontaneously, but becoming increasingly combative, perhaps secondary to a brain injury. He could not effectively keep his airway clear without help in the

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form of suctioning. It was concluded he would require active airway management.

Stop and consider how you would continue to manage his airway based on your skills and knowledge.

Attempts were made to assist in ventilating this patient via bag-valve-mask (BVM). The caregivers had a very difficult time with the BVM method due to confounding factors.

First, the large amount of bleeding made it difficult to keep the airway clear. Second, the lack of dentures and the facial fractures made obtaining and maintaining a seal with the mask very difficult, requiring two persons, one to hold the mask in place and the second to compress the bag. Despite appropriate interventions, the patient was becoming increasingly combative.

What are the crew's options? How would you proceed? Ground transport to a trauma center would be 45 minutes and flight time by helicopter about 15 minutes. How do these time frames affect your choices and decisions? The helicopter air ambulance has two crewmembers to manage the patient and the airway. Does this influence your decision?

Does this airway case cause you concern? It should! This could be described as an "airway nightmare." No matter your level of training, this case would be difficult at best, terrifying at its worst.

DISCUSSION

Oxygen Administration

Since airway is the A of the ABC's of patient care it must be considered first in each patient care scenario. An essential first step in airway management is oxygen administration, preferably by non-rebreather mask, and close observation. Oxygen administration is very beneficial for the patient who has spontaneous respirations and is maintaining an airway, i.e., the patient has a gag reflex and has no physical obstructions to airflow. Early oxygen administration is important due to the fact if oxygenation subsequently becomes a problem, the more oxygen in the lungs, the more reserve the patient will have. This reserve is called the Functional Residual Capacity (FRC) of the lungs which can function for a short period of time as a reservoir of oxygen. The FRC is an area of the lungs not ventilated during normal breathing. The FRC typically is made up of a mixture of

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oxygen, nitrogen and carbon dioxide, similar to the makeup of our atmosphere. However, by administering high-flow O2 the FRC indeed becomes a reservoir of close to 100% oxygen. Clearly, in this case "simple" oxygen administration would not be sufficient.

Bag-Valve-Mask (BVM) Ventilation

A method of active airway management is BVM ventilation, sometimes called a BLS airway. This method is chosen if the simple administration of oxygen by nasal cannula or non-rebreather mask is not effective in maintaining ventilation and oxygenation. The BVM technique uses an oxygen delivery system to either assist a patient who is not effectively breathing, or to "breathe" for a patient who has no spontaneous respirations. This is a very effective technique assuming a good facial seal can be obtained and maintained with the mask and the airway is "open." On many occasions, BVM ventilation is the most appropriate method of airway management. In this case an effective seal could not be accomplished.

There are some airway adjuncts which can be used in concert with, or in lieu of, the BVM-BLS airway technique. These include the oral airway and the nasal airway. In the above scenario one of these modalities might have been useful for the caregiver, but this is uncertain. Probably they would not have been useful due to the distorted anatomy and the blood in the airway. Certainly, they would not be useful in terms of protection from pulmonary aspiration.

Endotracheal Intubation (ETI) Without Chemical Facilitation

Care givers trained in the skill of ETI, but without access to chemicals to facilitate the process, will have to try either to overcome the patient's resistance to laryngoscopy or wait until the patient becomes obtunded enough to place the tube without resistance. Before any action is taken by the caregiver, the ability to successfully place the tube without worsening the patient's already compromised condition must be strongly considered. For example, will the attempt result in an increase in intra-cranial pressure? Please see below and previous case study #7 on "Brain Injury" regarding these very important concerns. It would not have been a good idea to attempt ETI in this case without chemical facilitation.

Endotracheal Intubation with Chemical Facilitation

Also available for more advanced airway management is ETI assisted by chemical facilitation. The use of chemicals to sedate without inducing respiratory muscle paralysis is typically termed chemical facilitation. For example, use of a benzodiazepine such as diazepam (Valium®), or midazolam (Versed®), could

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result in sufficient relaxation to allow for ETI resulting in definitive control of the airway and prevention of pulmonary aspiration. Remember, concerns in this case regarding endotracheal intubation include distorted anatomy occasioned by the facial fractures, possible fracture and displacement of the larynx and ongoing bleeding, interfering with the ability to visualize the structures necessary to successfully complete the ETI. The use of chemical facilitation does not offer the added protection of muscular paralysis (see below) but it is a reasonable choice in this case if RSI is not within the crew's scope of practice.

Rapid Sequence Induction or Intubation (RSI)

The use of a combination of drugs to sedate, control fluctuations in intracranial pressure, and the use of a chemical such as succinylcholine, which will chemically paralyze the patient, is typically called rapid sequence induction or intubation (RSI). The specifics of RSI are beyond the scope of this review but the general concepts are very important so we will briefly discuss them.

Historically, RSI was used to prevent active regurgitation of stomach contents during the physical act of laryngoscopy. Prevention is accomplished by chemical paralysis of all muscles, so active vomiting induced by muscle contraction/spasm cannot occur. An added benefit when chemical paralysis is used is lack of resistance to the stimulus of intubation, resulting in absence of the capacity of the jaw to clamp shut and of the vocal cords to spasm. Sedation is essential because it is inhumane to paralyze and intubate a patient who is aware of what is happening. Other chemicals used in the RSI process could protect the patient from abrupt increases in intra-cranial pressure (ICP) caused by intubation.

In a situation like the one described above, RSI combined with the act of ETI is an excellent option for the appropriately trained caregiver. However, it is not without significant risk of complications. The number one concern is once you chemically paralyze, you are solely responsible for oxygenating the patient. If, for any reason, you are unable to do so, the patient will experience profound consequences up to and including death. Obviously, the practitioner who is skilled in RSI must also be skilled at deciding if he or she can indeed "get the tube" once having initiated the RSI process. Limiting concerns in this case are the blood in the airway, multiple lacerations and fractures of the face and potential laryngeal and tracheal trauma, all of which decrease the probability of successful ETI. These same factors also make maintaining a BLS airway difficult. A conundrum. In each case, all the potential benefits and pitfalls of each airway management technique in conjunction with the skill and expertise of the caregiver must be considered before a method is chosen.

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Cricothyroidotomy

If ETI is unsuccessful and the care giver is unable to ventilate, the next step in the airway management algorithm is cricothyroidotomy, which can be attempted by open surgical cricothyroidotomy (CTM), closed via wire guided (Seldinger) technique, or needle technique. A needle cricothyroidotomy could be an effective temporizing measure while the other methods of cricothyroidotomy are being readied. It is important the caregiver be trained and practiced in CTM. Like other methods of airway management, CTM is not without its potential problems. Distortion of neck anatomy secondary to trauma (causing subcutaneous air, swelling, lacerations and blood) or obesity of the patient can make it difficult to identify surface landmarks. For practitioners trained to execute it, the cricothyroidotomy is the airway management procedure of choice when ventilation cannot be achieved by a less invasive technique. All practitioners who perform RSI should be trained in cricothyroidotomy, keeping their skills current. The presence of neck trauma and deformity would probably have made it difficult to perform a cricothyroidotomy in the case described.

THE CREW'S DECISION

The helicopter air ambulance team in this case made a decision to manage the airway by using RSI to facilitate the insertion of an endotracheal tube. After sedation and chemical paralysis, the first attempt at oral endotracheal intubation was unsuccessful. There was a large amount of blood present in the airway. After aggressive suctioning, the patient's trachea was successfully intubated (to the crew's great relief) on the second attempt. Tube position was confirmed by auscultation, bilateral chest rise, oxygen saturation and ETCO2. The patient was then transported via helicopter to the nearest trauma center with a secure airway.

HELPFUL HINTS

Following are hints which could be helpful when performing ETI. Remember cricoid pressure (the Sellick maneuver) should always be applied to prevent passive regurgitation, decrease the probability of distending the stomach when pre-oxygenating, and perhaps displace the vocal cords posteriorly for better visualization. Cricoid pressure should be applied at the time of BVM intervention in the unconscious patient and at the time chemical sedation is taking effect in the patient undergoing RSI.

A modification to the Sellick maneuver is External laryngeal Manipulation, (ELM) this is using cricoid pressure but then moving the larynx up, down, left and or right until a good view of the cords is achieved. This is best done with another

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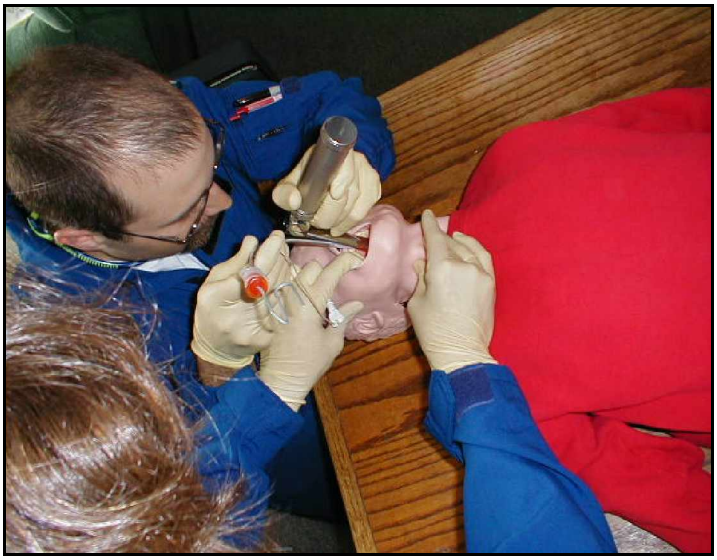
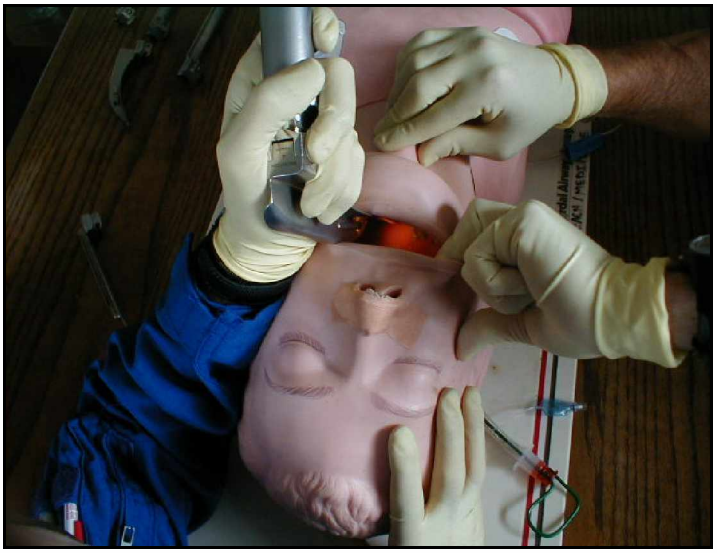
care giver using their hand to hold the larynx then in intubator will move that hand until a good view is obtained and the non intubator then just holds that position.

Another helpful technique developed by Dr John McDonald (the founder of REACH) to enhance the capacity to perform endotracheal intubation has been termed the POCPOM maneuver, i.e. **P**ull **O**ut **C**heek, **P**ush **O**n **M**axilla. See illustration.



LEGEND: Also demonstrates the ELM and POCPOM maneuvers. Note the position of the left thumb pushing on the maxilla, holding the head in the midline position and the index finger pulling on the cheek to enhance visualization and intubation. Also note the right hand performing the BURP procedure.



LEGEND: Demonstrates the ELM and POCPOM maneuvers (also see text.) Person assisting the intubator is A, with the right hand displacing the larynx backwards to compress the esophagus so as to inhibit aspiration and stomach insuflation during preoxygenation with bag-valve-mask ventilation. The larynx can then be moved around until the best view of the cords is found. B, with the left index finger pulling out the cheek to enhance visualization of the oral pharynx, epiglottis and cords and more space for the intubator to work when placing the endotracheal tube with the laryngoscope in place.

And, with the left thumb pushing on the maxilla. The purpose of this maneuver is to keep the head in the midline since there is a tendency when pulling out the cheek with the index finger to rotate the head on its vertical axis to the right.

SUMMARY

It is important to choose in each individual case the best process for airway management. Once a level of airway intervention is initiated, the method must be continuously re-evaluated to make sure conditions have not changed rendering the chosen method no longer useful. The most highly trained person should obtain and maintain the most appropriate and secure airway for each patient. It is impossible to decide prospectively how each airway should be managed. Important considerations are:

1. The level of training of the care giver (which, obviously, sets its own limits)
2. Is the patient maintaining his or her own airway and, if not, what method of intervention is appropriate
3. Presence of facial and/or neck trauma with bleeding and distortion of anatomy
4. Closed head injury which warrants constant awareness of the potential effects changes of your intervention on intra-cranial pressure
5. Potential for pulmonary aspiration from any source
6. Increased muscle tone to the point both a BLS airway and ETI are difficult, if not impossible, to achieve
7. The length of time until the next phase of care is to be reached
8. The method of patient transportation

If the travel time is short and the caregivers are able to maintain a good BLS airway, then a BLS airway is likely the best choice, even if practitioners with advanced training are present. If the transport time is long and there will be limited personnel to perform many functions during transport, then perhaps a more advanced airway is indicated. As stated above, it is impossible to determine in advance what each case will require. This is why we refer to these procedures as AIRWAY MANAGEMENT.

In our case, the flight crew processed all of these considerations and decided RSI was the best option. Using the skill of the paramedic/nurse combination on REACH, they successfully secured an advanced airway and were able to move beyond the A of the ABC and transport this patient successfully to the nearest trauma center.

KEY POINTS

- Each airway management case must be individualized; there is not one "answer" for every case.
- Oxygen is always part of airway management.

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- The method of airway management in each case is determined by multiple factors, which are dynamic.
- A BLS airway could be all that is needed, if it results in effective ventilation and oxygenation.
- The most skilled person available should attain, maintain and protect the airway.
- Whatever method is chosen, it needs to be constantly re-evaluated and modified if necessary to maintain a stable and secure airway which results in ventilation of the lungs and oxygenation of the tissues.

We would welcome any questions or comments about this case study. We would also welcome any suggestions relevant to developing a case study from an interesting case involving your unit and REACH.

Let us hear from you. Should you desire to read previously published case studies and the opportunity to receive additional CEUs, visit our website at www.reachair.com. You can do so online.

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CASE STUDY POST TEST

AIRWAY MANAGEMENT FOR PATIENT WITH FACIAL INSTABILITY

QUESTIONS: choose **all** correct answers.

1. There is one correct method to manage all airway situations.
   A. True
   B. False

2. Oxygen should be administered to:
   A. Only patients with pulse oxymetry less than 92%
   B. All patients who have sustained a traumatic event requiring transport to a hospital
   C. Patients with blood in the airway
   D. Only patients who will be endotracheally intubated

3. Factors which can make a BVM/BLS airway difficult to attain/maintain include:
   A. Facial hair
   B. Facial fractures
   C. Blood
   D. Lack of dentures
   E. All of the above

4. Attempts at ETI should be made:
   A. Whenever the care provider has the skill to do so
   B. For short ETA transfers
   C. When BVM ventilation is unsuccessful, ETA is greater than 15 minutes and the care provider has the experience
   D. Never in the head injured patient

5. Functional residual capacity is:
   A. Air in the alveoli of the lungs
   B. Air space in the lungs that is not ventilated during normal breathing
   C. Total oxygen capacity of the "upper airways"
   D. A measure of compliance of the Ambu-bag

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6. Which is the best method of definitive control of the airway and protection from pulmonary aspiration?
   A. Bag-Valve-Mask
   B. Oral airway
   C. Endotracheal tube, cuffed or snugly fitting
   D. Nasal airway

7. All persons trained in ETI and RSI must also have the skills and knowledge to:
   A. Pre-oxygenate
   B. Perform a cricothyroidotomy
   C. Direct assistants to perform the Sellick maneuver (cricoid pressure)
   D. Assess the potential risks involved
   E. All of the above

8. Once an airway management method is initiated:
   A. Forget it and move on to the B and the C of the ABC's.
   B. Responsibility for maintaining the airway should be assigned to a volunteer first responder.
   C. The airway should constantly be re-evaluated as to its effectiveness in ventilating the patient.
   D. Be prepared to proceed to a more advanced method immediately, if necessary.

9. Factors which could facilitate ETI include:
   A. Head position
   B. Having an assistant pull the lip and cheek tissues laterally while maintaining midline position of the maxilla (the POCPOM maneuver) to enhance visualization
   C. External laryngeal manipulation
   D. A back up suction source
   E. All of the above

10. All trauma patients flown in a helicopter air ambulance should be endotracheally intubated.
    A. True
    B. False

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Evaluation - Case Study: Airway Management for the Patient with Facial Instability

1. Did the Case Study Review meet the above listed objectives?
   - ☐ Yes
   - ☐ No
   - ☐ Partially

2. Is the format "user friendly"?
   - ☐ Yes
   - ☐ No
   - ☐ Partially

3. On a scale of 1 to 10, please grade the value of this Case Study to your clinical practice.

1 2 3 4 5 6 7 8 9 10
(Not Valuable) → (Very Valuable)

Return the completed post test and course evaluation. If you receive a grade of 70% or above you will receive a certificate for 1.0 contact hour. In order for us to send you the certificate please provide us your mailing address.

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