

Airway forum

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(Intern Emerg Med 2006; 1 (2): 151-154)

Dr. Peter Rosen: It is my pleasure to serve as our first airway forum's moderator. Today's patient is a 71-year-old morbidly obese man who was initially evaluated in a community emergency department with a chief complaint of chest pain. He experienced a syncopal event in conjunction with the onset of his chest pain. The patient bit his tongue as he fell to the ground leaving a notable lingual laceration. It was thought that he was experiencing a myocardial infarction and arrangements were made for transfer to an alternative site with a receiving community cardiologist and intensive care unit (ICU) setting, as these services were not available at the initial hospital.

Before transfer, the patient was given intravenous tissue plasminogen activator, intravenous glycoprotein IIb/IIIa inhibitor, intravenous heparin, and oral aspirin. His chest pain resolved with intravenous nitroglycerin and morphine. He was transferred without further syncope or dysrhythmia. His tongue, however, continued to swell during the 60-min transport time to the receiving facility. Shortly after the patient's arrival to the ICU, the emergency physician (EP), responsible for covering all arrests in the hospital, was called as the patient had arrested. The EP found the patient pulseless, apneic, and markedly cyanotic. The patient's tongue had swollen to the point where it was protruding approximately 2 cm from his mouth. Bag-valve-mask ventilation was difficult due to the patient's distorted anatomy. The team initiated cardio-pulmonary resuscitation.

The EP made an initial attempt at endotracheal intubation without medications to sedate the patient. Insertion of the laryngoscope into the oropharynx was difficult, and neither the arytenoid cartilages nor the epiglottis could be visualized. A single attempt was made to pass the endotracheal tube blindly into the trachea.

This attempt was unsuccessful.

The EP, Kenny Bramwell, who managed this difficult case, is joining us today. He will be able to help us recreate the clinical scenario as we explore the correct management of this patient's airway.

As moderator I would like to pose an important question prior to discussing the airway management issues regarding this case, and that is, might this patient with anterior lingual trauma have been best served by avoiding thrombolytics^{1,2}? Should he have been transferred to a center specializing in cardiac catheterization due to his relative contraindication to this treatment?

Dr. Daniel Davis: I am not sure that most physicians would consider a tongue bite to be a significant enough trauma to exclude a patient from lysis. In fact, while I agree percutaneous reperfusion strategies are superior to lytics in most situations, I would not have withheld thrombolytics for fear that he might develop a life-threatening airway obstruction^{3,4}.

Dr. Rosen: We know the lingual laceration was significantly large. Perhaps we should start by re-defining trauma. Recognizing that this may indeed represent prominent recent trauma, should we therefore exclude the possibility of thrombolytics in this particular patient group.

Dr. Davis: We usually talk of trauma in a non-compressible site as being an absolute contraindication to lysis. I think few EPs would have predicted the resultant malignant airway complication. I would anticipate that most EPs would have proceeded with thrombolytics.

Dr. Kenny Bramwell: In retrospect, this was enough trauma to exclude the use of thrombolytics. Apparently, the transferring EP and the accepting cardiologist did not deem the lingual laceration to be a significant deterrent to thrombolysis. The decision was made to initiate treatment, and to transfer the patient directly from the community emergency department to the ICU under the care of the cardiologist. I was called to care for the patient once the patient's airway was obstructed by his protruding tongue causing a respiratory arrest.

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Dr. Rosen: Dr. Sakles, what would have been your approach to the management of this patient's airway?

Dr. John C. Sakles: This is a patient with profound distortion of his upper airway anatomy. If the EP is unable to insert an oral airway, it is highly unlikely that either bag-valve-mask ventilation or direct laryngoscopy with endotracheal intubation will be successful. In patients such as these, who are in cardiac arrest, the most important thing is to establish an airway to initiate immediate oxygenation and ventilation. The preferred approach, I believe, is a method that can be performed very quickly and has the greatest chance of success. In my opinion this is a surgical airway. In an emergency situation, this means a cricothyrotomy. Some physicians may choose to proceed with an airway rescue device such as a laryngeal mask airway (LMA) or a combitube as a temporizing maneuver. I believe this would be a mistake and such action would lead to the loss of critical time in an already compromised patient. While it may be possible to place an LMA or combitube temporarily, the edema and hematoma will no doubt continue to expand, making further attempts at achieving an airway virtually impossible. A surgical airway will ultimately be necessary to maintain control of the patient's airway and provide for effective ventilation. The EP has only one option to definitively manage this patient's airway, and it is the timely execution of a surgical airway.

Dr. Rosen: Dr. Davis, do you agree with these comments, or might you proffer another method to manage this patient's airway?

Dr. Davis: I would take a different approach to the management of this patient's airway. One should seek an immediate and temporary method to ventilate the patient while preparing for a surgical airway. Considering the lingual swelling is predominantly of the anterior third of the tongue, I would try to bypass the obstruction distally.

There are two techniques one might consider for achieving this goal. The first is to place an appropriately sized nasopharyngeal airway allowing you to get beyond the distal portion of the posterior tongue and close enough to the glottic structures to allow ventilation. EP physicians do not consider this technique enough, and they should remember that this represents an excellent method of temporary airway stabilization⁵.

If one is unable to buy time for the patient by using bag-valve-mask ventilation with a nasopharyngeal airway, placement of a combitube or LMA should be considered. If the hematoma and swelling are limited to the anterior third portion of the tongue, the EP may be able to get beyond the airway obstruction using a laryngoscope and inserting a combitube. It is not necessary to visualize the vocals cords or the arytenoid cartilages in order to place

a combitube. It would be enough to get beyond the anterior third of the tongue with a laryngoscope in order to place the rescue device. In fact, I would advocate that a laryngoscope be used for all combitube insertions to facilitate positioning of the large balloon beyond the posterior tongue but above the glottis and to avoid pharyngeal trauma.

Once temporary airway management is achieved and ventilation assured, one should quickly proceed to stabilize the patient's airway by performing either a surgical cricothyrotomy or tracheotomy.

Dr. Rosen: Temporizing the airway in preparation of a definitive procedure is an interesting approach to this patient. Dr. Wolfe, please comment on this method of airway management.

Dr. Richard Wolfe: Blind nasotracheal intubation is often considered in patients with swollen tongues from angioedema. However, this requires that the patient remains alert and has breath sounds to guide placement, certainly not the case in this patient in full arrest. Furthermore, the risk of nasal bleeding after lysis makes any instrumentation of the nose undesirable. Retrograde intubation is often suggested as an alternative method to cricothyrotomy. It requires the placement of a guide wire through the cricothyroid membrane and into the pharynx in a retrograde fashion. The guide wire is then used to aid placement of an endotracheal tube. Retrieving the guide wire requires good visualization of at least a portion of the retropharynx, and the procedure can be both time consuming and of limited success⁶. Because of this, it would be a very poor choice in this setting. Finally, percutaneous transtracheal ventilation may be done swiftly but requires an elaborate set-up that is almost certainly not available in an ICU setting. Furthermore, it does not protect against aspiration, a critical goal of airway management in the setting of cardiac arrest.

Dr. Rosen: What would be the safest approach to establishing this patient's airway?

Dr. Wolfe: When choosing a technique for airway management, one needs to not only consider the odds of success, but also how rapidly the airway must to be secured to address the underlying problems. In this case, the fact that the patient is in cardiac arrest mandates the most rapid approach to maximize oxygenation and prevent aspiration. The only two techniques with both a high success rate and short procedure times are rapid sequence intubation and cricothyrotomy. Since rapid sequence intubation is precluded in this case by the inability to visualize the retropharynx, cricothyrotomy is the only true option.

Dr. Rosen: It is my understanding that due to the obstructing tongue hematoma, insertion of a

laryngoscope was not possible. Dr. Bramwell, is this correct?

Dr. Bramwell: That was the case. Direct laryngoscopy was impossible due to the size of the obstructing tongue. The tongue was protruding out of the mouth such that identification of structures in the oropharynx and placement of a laryngoscope were not feasible.

While trying to establish a temporizing airway may seem like a tempting idea, my evaluation of the patient was that immediate and definitive airway management was necessary with a surgical airway.

Dr. Rosen: Dr. Ban, considering the extensive lingual swelling, is there any chance one might try to approach this airway using a gum elastic bougie?

Dr. Kevin M. Ban: The gum elastic bougie is an excellent rescue technique for patients with extremely anterior located vocal cords, and for those already in arrest. It is a technique requiring almost no set-up time and one with a very low complication profile. One places the bougie, a rigid plastic guide with a curved end, into the trachea such that the endotracheal tube can be passed over the guide using a modified Seldinger technique. Ideally, the bougie is used when one visualizes the posterior cords or at least the arytenoid cartilages. As one becomes more proficient using the bougie, it is possible to place the guide in the trachea when only the epiglottis is visualized. This is achieved by passing the bougie beyond the epiglottis in an anterior direction. If it is placed appropriately in the trachea, one will feel the "clicks" of the tracheal rings as the bougie is passed more deeply into the airway. The absence of "clicks" as the guide is advanced suggests it is in the esophagus and should be removed.

In this patient with extensive anatomy distortion, it would be impossible to place the bougie in a safe manner since a minimum requirement of this device is that it requires the help of a laryngoscope to visualize the anatomy of the posterior oropharynx. Never try to place a gum elastic bougie blindly. The only option for definitive airway management in this patient would be a surgical cricothyrotomy conducted in an expedient fashion.

Dr. Rosen: Dr. Sakles, you have extensive experience using the fiber optic scope and video assisted intubation. Is there any role for these techniques in the management of this patient's airway?

Dr. Sackles: The fiber optic scope and video assisted intubation can be very helpful in situations where airway management may prove difficult. However, they do have their own limitations. One is that they, by their intrinsic nature, take some time to use. Unfortunately, you don't have the luxury of time in this case as the patient is in

arrest. The other limitation is that blood greatly impairs the ability to see the airway anatomy with fiber optic devices. In this case, with a large, swollen, bloody tongue, visualization of the airway is likely to be compromised and thus the likelihood of successful intubation greatly reduced. For these reasons I don't believe fiberoptic intubation would be a good choice in this case.

Dr. Rosen: My experience with fiber optic scopes is that they are most useful when there is limited oral secretions and bleeding. As the oropharynx becomes filled with secretions and bleeding, the fiber optic scope becomes less useful. In this patient with massive oral bleeding, even if one were able to pass the scope it would be nearly impossible to visualize necessary structures due to the extensive nature of the bleeding.

Dr. Bramwell, since the bleeding was predominantly anterior and the patient was unconscious, might it have been possible to pull the tongue further out of the mouth so as to relieve the obstruction and attempt orotracheal intubation?

Dr. Bramwell: The bleeding and swelling were not limited to a single portion of the tongue. If it had been a more focal injury with less swelling, such an approach may have proved successful. The bleeding initially started in the anterior portion of the tongue but as the bleeding worsened the edema tracked along to the posterior portion of the structure pushing the obstructing tongue out of the patient's mouth and into the deep posterior oropharynx. The result was complete airway obstruction without the possibility of entering the mouth.

Dr. Davis: We must be cautious when approaching the surgical airway and be sure not to rush into what may become a complicated procedure. In the non-arrested patient, the most prudent approach is to assure temporary ventilation prior to the surgical procedure, and to maintain ventilation during the placement of the cricothyrotomy. In fact, assuring ventilation during the surgical airway may prove life saving to the patient.

Dr. Rosen: We have determined the only approach to definitive airway management in this patient was with a surgical airway. Dr. Bramwell, was your surgery complicated by excessive bleeding?

Dr. Bramwell: The amount of bleeding I encountered with this surgical airway was the most I had ever seen in any procedure I had ever performed. I used continuous bedside suction to aspirate the surgical field. I anticipated a good deal of bleeding but did not expect to encounter what amounted to approximately 700-800 ml. of blood. The surgery was further complicated by the patient's extreme neck girth, as he was morbidly obese. I chose to approach the surgical airway by performing a

vertical incision. Due to the emergent nature of the situation, I performed the procedure with a scalpel and my left hand. I was unable to locate a surgical airway kit in the ICU.

Dr. Rosen: One cannot efficiently run an emergency department or ICU on the basis of an immediate response to an unexpected problem. It would appear to me that there should have been a difficult airway kit including surgical airway instruments available in the ICU prior to beginning the procedure. It is the obligation of the EP to be sure he is prepared to manage the difficult airway when he is called upon to do so. If this means one needs to carry an airway kit with him at all times, I endorse this approach.

Dr. Bramwell, did you have adequate nursing support during the procedure?

Dr. Bramwell: After my failed attempt at orotracheal intubation, I began to prepare the neck for a surgical cricothyrotomy. The nurses protested saying the patient had a contraindication to surgical airway as he had recently undergone thrombolytics. The other challenge was trying to assemble the necessary surgical equipment for the cricothyrotomy in a location that did not have these tools at the ready. Ultimately, I used a scalpel, without the benefit of a trousseau dilator or tracheal hook.

Dr. Rosen: Frequently unusually performed and necessary procedures are resisted by people who are not used to seeing them performed. Part of emergency medicine is the willingness to do something different to accomplish a task that not everyone around us has the same willingness to perform.

Dr. Davis, is there any advantage to performing a tracheotomy instead of a cricothyrotomy when there is significant potential for bleeding?

Dr. Davis: I do not believe EPs should consider tracheotomy as an alternative technique to cricothyrotomy, as tracheotomy requires a deeper surgical approach and an increased bleeding risk. The exception to this advice is in the rare case of tracheal injury or tumor preventing cricothyrotomy, or "high tracheotomy" as it was originally described.

When called upon to perform this procedure, I suggest considering that cricothyrotomy should be considered a tactile rather than a visual procedure. In fact, the scalpel blade can be used as a tactile instrument once the incision is performed. In addition to palpating for relevant structures, the physician may use the metal scalpel to tap

his or her way down the cartilaginous thyroid cartilage rings until the cricoid membrane is reached. The neck anatomy is rarely similar to the cadavers we use to teach cricothyrotomy, and bleeding often obscures the surgical field. Using the scalpel to locate the cricoid membrane helps the operator perform the procedure. Complications can be minimized by the quick identification of the cricothyroid membrane, which is a notably anterior structure.

Dr. Sakles: In closing, I think we should comment on the role of early intubation in a patient such as this. We must keep in mind that even though a patient may be ventilating adequately, there are times when the most conservative management and prudent approach is to intubate early when airway anatomy may be distorted by the progression of the disease process. In this patient with airway obstruction secondary to an obstructing swollen tongue, the most conservative approach to his airway would have been early orotracheal intubation prior to his transfer to the ICU. Such an action may have prevented his airway dilemma and subsequent arrest.

This approach may lead to the unnecessary intubation in some patients, but will prevent the development of the difficult airway seen in this patient.

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