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The following two cases were submitted for the case competition in 2016. They are presented to illustrate the theme of airway trauma.

### Case Review: Airway Trauma

#### Case 1: Tracheal Transection

Pre-hospital:

The patient is a 5-year-old female with no pertinent past medical history who was a restrained rear passenger involved in a head-on motor vehicle accident. At scene, she was nonverbal, but alert and cooperative. She was in acute respiratory distress, so the left chest was decompressed by EMS with an 18 gauge angiocatheter. She was transported with bag valve mask (BVM) ventilation in stable condition while maintaining her airway.

ED Course:

On arrival to emergency department, she continued to initiate breaths on her own with severe sternal retractions. She was continued on BVM ventilation with supplemental oxygen. There was obvious deformity and abrasion overlying the anterior neck with crepitus as well as significant emphysema to the anterior neck without active bleeding or airway compromise. Her initial vital signs were heart rate of 99, respiratory rate of 24, blood pressure of 115/53, and pulse oximetry of 100 percent. Chest x-ray revealed bilateral pneumothoraces, pneumomediastinum, large pocket of subcutaneous emphysema of the anterior neck concerning for tracheal injury, and left clavicle fracture. Needle decompression of the right second interspace with 18 gauge angiocatheter was performed with rush of air and immediate decrease in work of breathing. Anesthesia was present and managing the airway. Since she remained stable without desaturations or airway compromise, intubation was deferred until definitive airway could be performed in the operating room (OR) with ENT and trauma surgery services.

OR:

In the OR, a right 16 French Chest tube was placed. Laryngoscopy noted that the vocal cords were bilaterally mobile without any injury. Next, a rigid bronchoscope was passed through the cords. A complete tracheal transection at the level of the 4th tracheal ring was present. The distal stump was separated by 1 to 2 cm of soft tissue. With some difficulty, the distal stump was cannulated with the bronchoscope, and the patient was ventilated through this conduit maintaining saturation. The distal portion of the trachea was then retracted superiorly. A stay stitch was placed through the top ring. The bronchoscope was removed, and the endotracheal tube was placed into the trachea. Cuff was inflated and connected to the anesthesia circuit. The patient began ventilating well. The trachea was primarily anastomosed using multiple interrupted sutures and found to have a watertight seal at the conclusion of the procedure. A new transnasal endotracheal tube was placed past the level of the anastomosis. The cuff was inflated as the original endotracheal tube was removed. A Penrose drain was placed through either side of the anterior cervical incision. Postoperatively, patient was admitted to the ICU.

#### Post-Op Care/Disposition:

After two days, she was extubated without difficulty. She continued to improve with nasoenteric feeds. On post trauma day 7, a video swallow study was performed showing passage of food bolus. She was discharged on post trauma day 8 to home on honey thick liquids.

### Case 2: Tracheal Transection: Laryngotracheal/Esophageal Disruption

#### Pre-Hospital:

A helmeted 13-year-old boy was injured while riding a dirt bike when he struck his neck on a wire cable strung across a trail. He was knocked off the bike but did not lose consciousness. He was able to only speak in gasps. A witness called EMS and the patient was transported by ground ambulance to a rural critical access hospital. The EMS crew tried to maintain an airway and attempted bag mask ventilation, the patient could only breathe while sitting upright.

#### ED Course:

On arrival in the ED he was in respiratory distress with oxygen saturations in the 80's and was noted to have marked neck swelling with crepitus and copious bloody oral secretions. The EM physician performed drug assisted orotracheal intubation. CT scans of the head, cervical spine, and chest were performed. The chest scan showed the tip of the ET tube in barely bridging a transected trachea; no other injuries were identified. The patient was transported by ground ambulance to the trauma center (2-hour transport, no available helicopter). The highest-level trauma team activation was called and the patient was evaluated per ATLS protocol.

OR:

Approximately 30 minutes after arrival to the trauma center's ED the patient was brought to the operating room by pediatric surgery and otolaryngology. The patient was prepped from chin to mid thighs and a perfusion team was available if femoral arteriovenous bypass was needed). A collar neck incision was performed; upon division of the strap muscles a transected trachea was encountered with the distal trachea being held from retracting into the mediastinum by adventitial tissue. The distal trachea was grasped with Allis clamps and sutured to the drapes to hold it in place. The ET tube was withdrawn and the distal tracheal stump intubated. There was complete laryngotracheal disruption with avulsion of the laryngeal mucosa and full thickness disruption of the 85% of the circumference of the esophagus. The esophagus was repaired with a single layer of 3-0 polydioxone. A tracheostomy was performed at the level of the third tracheal ring. The laryngeal mucosa was repaired and the larynx reattached to the trachea. A pack was left to stent the laryngeal mucosa. A feeding jejunostomy was placed. The patient was brought to the PICU.

Post-Op Care/Disposition:

Later that day he underwent a carotid CT angiogram (negative) and cervical MRI (equivocal for atlanto-occipital dislocation). The laryngeal stent remained in place for 14 days. At the time of stent removal bronchoscopy showed bilateral vocal cord paralysis consistent bilateral recurrent nerve injury. A swallow study showed the esophagus to be healed. The patient had his swallowing evaluated and was able to tolerate a regular diet. Follow up cervical spine imaging was negative for injuries. A talking tracheostomy was placed. He was discharged home on day 27. Long term he had issues with airway granulation that required multiple laser treatments. He underwent a right vocal cord lateralization procedure and may possibly have his tracheostomy decannulated in several months. His esophagus and swallowing are normal.

### Topic Review: Pediatric Neck Trauma

Pediatric airway injuries are relatively rare but are increasing in frequency due to the increased mobility of children, and society in general. The most common mechanism of injury for pediatric neck trauma is motor vehicle collisions followed by bicycle related accidents. Clothesline injuries remain a rare cause of this injury.

A high index of suspicion is needed for any child with a neck injury. Presenting symptoms may be as subtle as mild dysphonia or hoarseness of voice or more pronounced like acute stridor or respiratory distress. Other symptoms include dyspnea, dysphagia, anterior neck pain, cough and/or hemoptysis.

Physical exam may reveal crepitus, subcutaneous emphysema, edema, abrasions or bruising of the neck. There may be a loss of laryngeal landmarks (the thyroid cartilage prominence, for example) or palpable fractures.

It is also important to remember that the patients who are initially stable may rapidly deteriorate.

The mainstay of prehospital management remains airway management. ATLS protocols should be maintained and the spine should be immobilized. Oxygenation and ventilation (likely by bag-valve mask) should be provided until the patient arrives at the receiving facility. Blind attempts at intubation should be minimized and rapid transport is essential. Pneumothoraces may be stabilized with needle decompression.

Management in the Emergency Department (ED) depends on the stability of the patient. If the patient is stable, time can be spent obtaining a detailed history and physical examination. If available, flexible fiberoptic laryngoscopy may be performed at bedside. Systemic corticosteroids can be administered to help with airway edema. Plain radiographs can be obtained to evaluate pneumothoraces, pneumomediastinum and subcutaneous emphysema. CT scan of the neck can provide valuable information regarding fractures and vascular injuries. One must remember, however, that imaging is not foolproof and injuries can be missed. Evaluation of the potential airway injury should be done in conjunction with the trauma surgeon and, if available, the ENT surgeon.

If the patient is unstable, endotracheal intubation should be performed by the most experienced provider and ideally in the operating room. If the intubation needs to be performed in the ED, direct laryngoscopy with or without fiberoptic guidance and intubation with a smaller endotracheal tube can be effective. Needle cricothyroidotomy should be saved as a last-ditch effort to secure the airway.

In the operating room (OR) rigid endoscopy/bronchoscopy can be performed to evaluate for injuries, and secure an airway with an endotracheal tube or tracheostomy. Open neck exploration and surgical repair can be performed once the airway is secure and the patient is well anesthetized.

There is a classification system created by Fuhrman et al for laryngotracheal injuries:

Group 1	Minor endolaryngeal hematoma without detectable fracture
Group 2	Edema, hematoma, minor mucosal disruption without exposed cartilage
Group 3	Massive edema, mucosal tears, exposed cartilage, cord immobility
Group 4	Group 3 with more than 2 fracture lines or massive trauma to the laryngeal mucosa
Group 5	Complete laryngotracheal separation

Traditionally, groups 1 and 2 are managed conservatively and groups 3-5 are managed with surgical intervention.

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