Combined tracheoesophageal transection after blunt neck trauma

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Abstract

Survival following tracheoesophageal transection is uncommon. Establishing a secure airway has the highest priority in trauma management. Understanding the mechanism of the incident can be a useful adjunct in predicting the likelihood and severity of specific anatomical patterns of injuries. We discuss published literature on combined tracheoesophageal injuries after blunt neck trauma and their outcome. A search of MEDLINE for papers published regarding tracheoesophageal injury was made. The literature search identified 14 such articles referring to a total of 27 patients. Age ranged from 3-73 years. The mechanism of injury was secondary to a rope/wire in 33%, metal bar in 4% of cases and unspecified in 63%. All of the patients were managed surgically. A number of tissues were used to protect the anastomosis including pleural and sternocleidomastoid muscle flaps. There were no reported mortalities. Patients with combined tracheoesophageal injury after blunt neck trauma require acute management of airway along with concomitant occult injuries.

Keywords: Esophageal injury, neck trauma, tracheal injury

INTRODUCTION

Combined blunt traumatic injuries of the trachea and esophagus are infrequent and most patients with complete tracheal transection probably die at the scene due to loss of the airway.[1] The few who survive and arrive at a hospital will pose a challenge to the trauma team in terms of acute management of the airway and diagnosis of occult injuries. These patients may suffer fatal outcomes if misdiagnosed or long-term complications if improperly treated. The signs and symptoms require a high index of clinical suspicion. In patients with a transected trachea utmost care must be taken not to convert a partial injury to a complete transection. If unrecognized it is likely to result in a fatal outcome if the distal segment is not intubated. Fiber optic intubation should be used in patients in whom airway trauma is suspected.[2,3]

METHODS

Selection

A search of MEDLINE for papers published regarding tracheoesophageal injury was made. The following MeSH headings were used: Tracheal injury, esophageal injury, tracheoesophageal transection and aerodigestive injuries. The search was limited to combine tracheal and esophageal injuries after blunt neck trauma and was confined to articles published in English.
Data extraction

The data extracted from each publication was: First author, publication year, age, time to surgery, mechanism of injury, level of injury, type of interposition tissue used, type of repair and outcome.

Outcomes of interest

The outcomes of interest were survival and post-operative complications.

RESULTS

Publications included

The literature search identified 14 such articles referring to a total of 27 patients [Table 1]. Age ranged from 3-73 years, 46% of the patients were under 25 years of age. This may be due to the prevalence of use of motorbikes in this age group where the neck is exposed and therefore prone to trauma from wires and hyperextension injuries. The mechanism of injury was secondary to a rope/wire in 33%, metal bar in 4% of cases and unspecified in 63%. At the time of presentation symptoms and signs included neck abrasions, laceration, sub-cutaneous emphysema, dysphonia and respiratory compromise. All of the patients were managed surgically. A number of tissues were used to protect the anastomosis including pleural and sternocleidomastoid muscle flaps. In 88% (n = 24) of the cases, primary repair was carried out at the time of surgery with good outcome. No mortalities were reported in the current literature review, airway was promptly established and associated injuries were identified at the time of surgery [Table 1].

Comment

Combined tracheoesophageal injury is rare and most trauma or emergency centers would have limited experience. The true incidence of combined tracheoesophageal injury is difficult to discern as most succumb at the scene due to compromised airway. Blunt neck trauma is also associated with cervical spine injury and only rarely with injury to the carotid artery.

Epidemiology

Patients with these injuries account for less than 1% of patients presenting to the hospital following trauma. Over 2,000 people in the United Kingdom die of neck trauma every year.

Mechanism of injury

Blunt trauma to the neck not only occurs during motor vehicle accidents but also occurs with sports-related injuries and strangulation. In motor vehicle accidents where driver is not belted, the driver may be thrust forward with the head extended, forcing the anterior neck against the steering column. The mechanisms of tracheal transection as proposed by Kirsh, et al. are as follows:

1. Impact to the exposed anterior aspect of the neck may crush the larynx or the trachea, particularly at the cricoid ring, and compress the esophagus against the posterior spinal column.
2. Rapid deceleration can also produce a shearing force that disrupts the trachea, which is fixed at the carina and cricoid cartilage.
3. Direct compression of the trachea between the sternum and vertebral column may produce a focal point for transection in association with other forces.
4. Reflex closure of glottis with an associated increase in intra-thoracic pressure may cause barotraumatic rupture.

Initial assessment and management

Standard principles governing assessment and management of a polytrauma patient should follow the
advance trauma life support (ATLS®) guidelines.[21] The primary goal should be establishment of a secure airway with cervical spine immobilization followed by assessment of the associated injuries. Fibre optic bronchoscopy can be used to direct the endotracheal tube safely into the distal segment of the trachea thus avoiding extra-tracheal intubation within the soft tissues of the neck. During the resuscitation and initial assessment phase, the cervical spine should be assumed to be injured and should be splinted using a cervical spine collar, two sandbags and a forehead tape.

**Signs and symptoms**

Clinical examination has a key role in trauma patients despite the routine use and advancement of radiological imaging.

Various signs associated with tracheal injury include aphonia, hoarseness, hemoptysis and subcutaneous emphysema.[22] These result from air escaping from the trachea into the surrounding tissues and a lack of air passing through the glottic region. Undiagnosed tracheal injury may become evident by presence of massive subcutaneous emphysema. An air leak on chest drain insertion may not be present unless there is breaching of the mediastinal pleura or an additional bronchopleural fistula.

Esophageal injuries may have more subtle signs and symptoms including vague chest pain, odynophagia and subcutaneous emphysema at the thoracic outlet. The presence of mediastinal pneumatosis with associated pleural effusions on chest films should raise such suspicion.[23]

Of the few patients with associated carotid artery injury, most remain asymptomatic or develop neurologic deficits shortly after injury. Typical symptoms of carotid artery injury are pain in the ipsilateral face or neck, followed by contralateral weakness or sensory loss. Horner's syndrome associated with pain is characteristic of carotid artery injury. The interval between blunt cervical injury and neurological deficits may be hours, days, or even months.[24]

Cervical spine injury is associated with presence of neck pain and tenderness with neurological deficit in the extremities.

**Investigations**

Performing whole body imaging on patients has become an accepted protocol in many trauma centers in the fear of missing an injury. Recent studies have shown that whole-body CT is associated with increased probability of survival in patients with polytrauma.[25]

Apart from clinical signs, radiological imaging indicating the presence of tissue pneumatosis with associated fracture of the upper ribs should raise the suspicion of an underlying airway injury. Endoscopic and CT assessment of the airway is indicated to ascertain the level and nature of injury.[3]

Esophageal injuries may require a combination of endoscopy and water-soluble contrast studies to detect any perforations. When a swallow is technically impossible or where a high index of suspicion remains despite a negative contrast study, flexible endoscopy may be used allowing direct visualization of the esophageal mucosa but care should be exercised in order to avoid exacerbation of an esophageal perforation.[26]

Conventional carotid angiography is considered the gold standard in diagnosis of carotid artery injury.[27] However, CT angiography allows for rapid and safe evaluation of the carotid artery.[28]

The 2007 NICE guidelines on imaging of head injuries[29] also contain guidance on cervical spine imaging in trauma patients. A three-view plain radiography series (lateral, antero-posterior and odontoid process projections) remains the initial investigation of choice. It is recommended that patients with a Glasgow coma score (GCS) below 13, intubated patients or patients being scanned for multi-region trauma should have CT scans rather than plain radiographs. Interestingly the American College of Radiology appropriateness criteria[30] recommend thin-section CT, not plain radiography, as the investigation of
Surgery

The repair of tracheoesophageal transection poses a challenge to the trauma surgeon, as these injuries are uncommon. A multidisciplinary approach is advocated.

Esophageal injuries

The time of presentation to institution of management has an important bearing in management of thoracic esophageal injuries. It has been shown that delayed diagnosis adversely affects outcome following esophageal perforation.\[31\]

Esophageal injuries may be managed conservatively with or without drainage procedures or by primary repair depending upon the extent of the laceration and the site of esophageal injury.\[16\] Oral intake should be avoided and nutrition maintained either by a feeding jejunostomy or parenterally via central line. If the nature of the esophageal injury is such that a primary repair is not achievable or the tissues are beyond repair then a staged reconstructive procedure is advisable.\[32\] Initial management in these cases would be to form diversion stomas in order to minimize mediastinal contamination. A neo-esophagus can then be fashioned using either a gastric or colonic conduit at an appropriate time as dictated by the clinical state of the patient.

Tracheal injury

The principal anesthetic consideration is ventilation. Early surgical repair is the preferred treatment for most patients with a transmural tear exceeding 2 cm in length.\[33\] Conservative treatment may be a viable alternative for some patients. This would include those with short lacerations in the upper third of the trachea, especially if they do not involve the entire thickness of the tracheal wall.\[34\] The use of local muscle flaps to buttress the trachea and separate the trachea from the esophagus is an important technique in the management of combined injuries of the trachea and esophagus.\[35\]

Recurrent laryngeal nerve injury

Recurrent laryngeal nerve injury can be expected in approximately 60% of patients with complete transection of the cervical trachea.\[36\] Bilateral vocal cord paralysis causes midline fixation and may lead to respiratory obstruction and thus threatens life. Tracheostomy is needed in such patients, while waiting for the return of function and in the perioperative period to allow edema to subside. If the vocal cord paralysis is permanent then several options to regain function is available one of which includes augmenting the glottic aperture.\[37\] This involves simultaneous bilateral resection of the posterior one third of the vocal folds including the vocal process. A posterior cordectomy allows for decanulation with preservation of respiratory function and phonation.

Carotid artery injury

Treatment options in carotid artery injury include observation, antithrombotic therapy, and endovascular stenting.\[38,39\] The need for surgical intervention is rare. The requirement for surgical reconstruction is determined by the thrombogenicity of the injured carotid artery, the state of the collateral circulation to the brain, the presence of an expanding hematoma or worsening neurological symptoms despite anticoagulation.\[39\]

Cervical spinal injury

The management of spinal trauma ranges from dealing with patients with trivial injuries through to major complex, spinal cord trauma which may be life threatening. Many patients can be managed conservatively. The options for non-operative treatment of the cervical spine range from the application of a lightweight
orthosis through to a reduction with halo traction and rigid stabilization with a halo jacket. The principles of treatment are to decompress neurological structures and restore vertebral column integrity. Indications for surgical stabilization in sub-axial fractures include failure of closed reduction, unstable injuries and progressive neurological deterioration.[40]

Complications

Complications of tracheoesophageal transection include esophageal strictures and tracheoesophageal stenosis.[13] Ischemia and anastomotic leaks are known risk factors in esophageal stricture formation.[41] Three patients in the current literature review underwent delayed repair of their injuries and of these two patients developed esophageal stricture formation[7,11] and one developed subglottic stenosis.[12] None of these patients developed anastomotic leak during their post-operative period. Stricture formation in these patients may be contributed by the severity of local tissue damage and ischemia at the time of the injury which had necessitated the staged reconstruction during their initial surgery. However, no stricture formation was seen in the group that underwent primary repair.

Tracheoesophageal fistula (TOF) is a rare complication. High cuff pressures, infection and ischemia are known factors that may be implicated in fistula formation.[42,43] Two layered closure of esophageal injury and re-enforcement with tissue flaps are protective of TOF formation[6] as inferred from the current literature review where none of the patients undergoing this type of repair developed delayed TOF.

Symptoms in TOF usually develop 3 to 10 days after the initial blunt trauma.[44] Coughing after swallowing, Ono’s sign is the classic symptom in TOF but other symptoms include hemoptysis, increased tracheal secretions, copious production of sputum, dysphagia, hoarseness, and odynophagia. The diagnosis is typically established with the use of contrast studies, endoscopy, and bronchoscopy. However, the false-negative rates are up to 33% for endoscopy and 12.5% for contrast studies.[45] Surgical repair should be carried out as soon as possible after diagnosis. Non-operative management carries a high mortality of 80%, while operative mortality is only 9.3%.[46] The repair is best carried out through a right posterolateral thoracotomy, which allows access to all levels of the trachea and esophagus. The use of interposition tissue is recommended not only to protect the suture line but also to prevent recurrence of TOF.[47] Temporary esophageal stenting may be an alterative option in patients who are critically ill and unable to undergo corrective surgery.[48]

In conclusion, presentation of patients to hospital with combined transection of the trachea and esophagus is rare after blunt trauma. Once an airway is secured in the acute setting a high index of clinical suspicion with appropriate contrast or endoscopic examination should be present to diagnose occult injuries including those to the esophagus.

Footnotes

Source of Support: Nil.
Conflict of Interest: None declared.

REFERENCES


Figures and Tables

Table 1

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Summary of published cases of tracheoesophageal transection due to neck trauma

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