Emergency department care of a patient after a total laryngectomy
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Patients who have undergone a total laryngectomy have altered anatomy and physiology. This results in unique and specific issues that must be recognized in order to ensure that this group of patients experience appropriate care. This article looks at the current literature and attempts to highlight specific areas of concern, so that emergency care providers can deliver an equally high standard of care to this patient group as they do to others. A Medline and Google scholar search was conducted using phrases associated with the complications of total laryngectomy. The results were analyzed to identify the most relevant articles that meet our objective. Articles were then organized into the different subheadings used within the article and reviewed. The most up-to-date articles or those that were in the opinion of the authors the most appropriate to convey our objective were included in our review. European Journal of Emergency Medicine 00:000–000 © 2013 Wolters Kluwer Health | Lippincott Williams & Wilkins.

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Emergency department care of the laryngectomee

According to the estimates of the European Union, in 2008 there were 29 000 new cases of laryngeal cancer [1]. Early laryngeal cancer can be treated with radiotherapy, chemoradiotherapy, organ preservation surgery including the use of a laser or a multimodal treatment regime. Recurrent tumour after radiotherapy or more advanced disease often necessitates total laryngectomy with the possible inclusion of radiotherapy and chemotherapy.

There are an estimated 5000 laryngectomy patients living in the UK [2]. People who have undergone a total laryngectomy procedure for laryngeal cancer have altered anatomy and physiology. This results in specific issues that must be recognized to ensure that this unique patient group is provided appropriate, good-quality emergency care.

A survey of members of the National Association of Laryngectomy Clubs in the UK highlighted concerns regarding emergency care received [2]. It has also been shown that the requirements of neck breathers (tracheostomy and laryngectomy patients) are not consistently included in local resuscitation programs [3].

Total laryngectomy involves surgically removing the larynx, with the creation of an end tracheal stoma and reconstruction of the pharynx.

Functions of the larynx include breathing, protection of the lungs and voice production. After surgery, protection of the lungs and a safe airway are maintained through the complete separation of the pharynx from the trachea. Therefore, the alimentary and respiratory pathways are independent of one another. The trachea is sutured to the skin of the anterior neck, creating an end stoma (Fig. 1).

Postoperatively, voice is most commonly restored through a tracheo-oesophageal puncture (TOP) and placement of a speech valve (Fig. 1, 4) [4,5]. This allows passage of air from the trachea into the neopharynx on occlusion of the end stoma. The speech valve prevents passage of foodstuffs from the neopharynx into the airway. Other methods of voice restoration or communication are through the use of an electronic larynx, oesophageal speech, silent articulation and written communication.

Laryngectomy patients can present to emergency care services either with specific complications secondary to their treatment or with unrelated conditions. However because of the fact they have undergone a total laryngectomy, certain factors must be kept in mind.

Laryngectomy or tracheostomy
In most cases a patient will be able to inform you on whether he/she has undergone a laryngectomy or tracheostomy. In a tracheostomy, there may be a patent airway above the level of the stoma, which in cases of tube obstruction or decannulation could possibly be intubated transorally. After a laryngectomy, there is no connection between the trachea and oropharynx.
If a patient is unable to inform you on which airway he/she has, there are a number of things that could aid in the differentiation between a tracheostomy and a laryngectomy. Look for MedicAlert bracelets or emergency cards that they may carry stating that they have undergone a laryngectomy. Some units provide patients with cards to carry in their wallets, which provide emergency advice on their airway status. In some regions ambulance services have a registry of telephone numbers and addresses of patients who have undergone a laryngectomy; this ensures that they respond to 999 calls from these numbers even if there is no speech during the call.

The majority of laryngectomy patients attending the emergency department will have an open stoma (i.e. without a tube in situ). Examining the stoma will usually allow differentiation between a tracheostomy side stoma and the end stoma of a laryngectomy (Figs 1 and 2). Examining superiorly through the stoma will allow you to visualize whether there is a patent passage superiorly. This will not be the case after a total laryngectomy. Laryngectomy patients will often have a TOP speech valve in situ (Fig. 1, 4), and if this is visible in the posterior tracheal wall it is indicative of a total laryngectomy.

General issues after laryngectomy

Airway

Unlike in tracheostomy, in which a side stoma into the trachea is created, there is no connection between the trachea and the oropharynx after a total laryngectomy (Fig. 2), meaning that total laryngectomy patients are obligate neck breathers. If a patient requires supplementary oxygen, it must be provided through the stoma. A well-intended face mask, nasal cannula, nasal airway or oropharyngeal airway achieves nothing.

In a resuscitation situation, the guiding principles should be to get the best available help as early as possible and to consider oxygenation a priority. Look, listen and feel for respiration at the mouth and the stoma. If the patient is breathing, high-flow oxygen should be supplied. If special laryngectomy masks are not available, a paediatric mask is a useful alternative. If there is uncertainty as to whether a patient has an end stoma (total laryngectomy patients) or a side stoma (tracheostomy patients), oxygen masks should be applied to both the face and the neck. An assessment of stomal and tracheal patency should be made. The humidification cover or button should be removed if in situ (Figs 3c and 4), and if there is a laryngectomy tube in situ that has an inner tube, the inner tube should be removed at this stage. It is not necessary
to remove the TOP speech valve (Figs 1, 4 and 3g, h). Removal of a TOP speech valve may potentially be harmful because of the risks of aspiration and trauma. Ensure that the stoma is clear and none of the tubes blocked with secretions or mucus. Stomal patency can be checked by passing a suction catheter through the stoma into the trachea. If the catheter passes easily, tracheal suction should be performed. If the patient is not breathing he/she can be ventilated with a bag-valve mask through the stoma.

If the stoma is blocked and a suction catheter cannot be passed, the next step would be to deflate any tube cuffs if present. Patients with a tube are unlikely to have a cuff, although it is possible. If the patient is not improving or is unstable, all laryngectomy tubes should be removed from the stoma, if present, and oxygen should be resupplied through the stoma. If ventilation is required, it can be achieved by bag-valve mask ventilation through the stoma by placing a paediatric face mask or applying a laryngeal mask airway over the stoma. The stoma can be intubated if required, and a small cuffed endotracheal tube of size 6 can be used, passing it over a bougie or fibre-optic scope if necessary. If not in a hospital setting, mouth to stoma resuscitation can be performed; however, transoral intubation cannot be performed. Suctioning of the airway should be performed using a suction catheter passed through the stoma into the trachea.

If the stoma is patent and the patient is distressed or breathless, a respiratory problem could be indicated, and continued assessment along the ABCDE algorithm should be performed to identify a cause.

Algorithms for the emergency management of the laryngectomy airway are available from the National Tracheostomy Safety Program website http://www.tracheostomy.org.uk/.

**Communication**

As mentioned previously, communication following laryngectomy can be achieved in several ways. For the uninitiated, understanding some of these forms of communication can be difficult initially and this can cause frustration for all concerned. Be patient and look at the patient’s mouth when they communicate. In some cases, getting the patient to communicate by writing information down can help. In an emergency situation, time is often a luxury in short supply and in these cases a history can be taken from a partner, friend or caregiver. However, try to communicate as much as possible with the patient directly, as you would with a patient who had not undergone a laryngectomy. A common complaint among laryngectomy patients is that people assume they are deaf and talk loudly or shout. Hearing loss can occur in conjunction with laryngeal cancer and is a recognized complication following treatment with platinum-based chemotherapeutic agents.
Delivery of inhaled or nebulized medication
Patients who have undergone total laryngectomy and require nebulized drugs should have them delivered through a tracheostomy mask placed over the stoma. The skin surrounding the stoma should be washed and dried when the drug has been delivered in order to prevent skin reactions. As with airway emergencies, if a tracheostomy mask is unavailable, a paediatric face mask placed over the stoma can be used instead.

Psychosocial
A diagnosis of advanced head and neck cancer and its treatment has been shown to affect some of the most fundamental and noticeable aspects of day-to-day life, which can have a dramatic impact on a patient’s psychosocial well-being [6]. It has been reported in a number of studies that, after treatment, patients with head and neck cancer show some of the highest rates of depression, anxiety states and suicidal tendencies compared with other groups of patients with cancer [7–9]. This must be borne in mind when assessing risk in patients who have undergone a total laryngectomy.

In addition, there is a higher incidence of chronic alcohol related problems in patients with head and neck cancer. This can complicate psychosocial support [8] and can lead to medical problems related to excessive alcohol consumption.

Problems directly resulting from total laryngectomy
Dysphagia
Many studies have shown a negative impact on swallowing after a total laryngectomy, with rates of dysphagia ranging from 10 to 62% [10,11]. After a total laryngectomy, loss of laryngeal movement on swallowing increases resistance to flow through the pharynx and oesophagus, doubling pharyngeal transit time. Greater propulsive forces are required to overcome increased pharyngeal resistance and achieve an effective swallow [12].

If the patient’s treatment regime included radiotherapy, swallowing can be further impaired secondary to xerostomia, submucosal fibrosis, gastropharyngeal reflux and lymphoedema.

Stricture formation in the neopharynx or oesophagus can occur at the site of surgical anastomosis or be a result of trauma secondary to speech valve insertion or an elongated valve projecting into the oesophageal lumen [13].

Dysphagia may be severe enough to warrant admission for intravenous rehydration and maintenance of adequate nutrition.

Careful examination of the postlaryngectomy patient with swallowing complaints is critical to rule out recurrent or new disease and to determine the cause of the swallowing problem; therefore, these patients should be referred to an ENT specialist to allow fibre-optic examination of the upper aerodigestive tract.

Nutrition
Many laryngectomy patients during their initial post-treatment period, and some for longer periods of time, receive nutrition through a nasogastric tube. Tube displacement and blockage is a common occurrence. Replacement of a displaced or blocked tube can be performed within the emergency department, with a postprocedure pH aspirate to ensure correct positioning. Care should be taken when replacing a nasogastric tube during the initial postoperative period as there is the potential for pushing the tip of the tube through the suture line in the pharynx. During the first 2 weeks after surgery, we feel that nasogastric tube replacement should be performed by an experienced ENT, head and neck or nutrition specialist.

Stoma problems
Because of the separation of the respiratory and alimentary systems, secretions from the respiratory system can no longer be swallowed and can therefore build up and crust around the airway. This is further exacerbated because of the loss of normal humidification and warming of air that occurs during normal nasal inspiration. Some patients are provided with a ‘heat moisture exchange device’ partly restore these functions (Figs 3 and 4). The stoma should be kept clean and any crust should be cleared away carefully using forceps. Crusts can be softened with nebulized saline, allowing easier removal. To reduce crust formation, humidified oxygen should also be used when possible.

Stenosis of the stoma can occur postoperatively, with published rates of tracheostomal stenosis varying from 4 to 42% [14,15]. The impact of stenosis on respiratory function seems to have more to do with the general condition of the patient and lower airways and lungs, and this must be taken into account when assessing the stoma. In some cases surgical correction of tracheostomal stenosis is required [16].

A laryngectomy tube or silicone stoma button can be inserted if there are concerns with regard to the size of the stoma (Fig. 3).

Tracheo-oesophageal puncture and speech valve complications
The function of the TOP and speech valve is to allow voice rehabilitation and prevent aspiration (Figs 1 and 3). Leakage can occur through the valve. This can be secondary to colonization of the valve with Candida or biofilm formation [17,18]. This necessitates a change of the speech valve, which should be performed by a practitioner who has experience with this procedure. Peripheral leakage can also occur; this is a result of enlargement of the TOP, which can be secondary to trauma, often following repeated valve change or tumour recurrence. Accepted treatment for this is valve removal.
and passage of a Foley catheter or nasogastric tube through the fistula to allow the puncture to narrow. This allows the patient to be fed, prevents complete closure of the fistula and reduces the risk of aspiration pneumonia, which, if it develops, could prove fatal [19]. Another valve can be reinserted later.

Displacement of the speech valve can result in aspiration of the valve itself. If a patient presents with loss of their valve, the fistula should be made safe as described previously, the respiratory system examined and a plain chest radiograph obtained to ensure that the valve is not lodged in the airway. A referral to an ENT or speech and language therapist should then be made so that a new valve can be sized and inserted.

**Pharyngocutaneous fistula**

Postoperatively, breakdown of the mucosal suture line after laryngectomy can result in salivary leakage into the surrounding soft tissue, resulting in a fistula [20]. This usually occurs apparent 7–11 days after surgery [21,22], and therefore, most patients are likely to still be inpatients. However, some fistulas can present later, and the length of hospital stay can vary widely from centre to centre.

Initial clinical signs include wound erythema in conjunction with facial and neck oedema. Although tenderness of the skin incision is the classic hallmark of soft-tissue infection, this may be reduced because of the neck paraesthesia, which is inevitable after total laryngectomy [20]. Early recognition of fistula formation can reduce the incidence of catastrophic wound complications, such as wound breakdown, exposure of great vessels and carotid artery blowout. Antibiotic therapy should be commenced, the patient should be assessed for aspiration pneumonia and then referred to the operating team. Adequate nutritional intake needs to be maintained throughout to support healing. Fluid collections can be aspirated, and if necessary exteriorized, allowing the diversion of the fistula from critical structures. A proportion of fistulas will heal without the need for surgical intervention [20].

**Radionecrosis**

Radiotherapy can be administered as part of a multimodality treatment combined with total laryngectomy, or in other cases, total laryngectomy can be performed after primary radical radiotherapy in the case of treatment failure or recurrence.

Radiotherapy induces hypoxia, hypocellularity and hypovascularity of the tissue bed. This can create a situation in which wound breakdown exceeds repair and a nonhealing wound can occur. Because of the impaired healing capacity, irradiated tissue is less able to repair itself from traumatic and infectious insults [23]. Radionecrosis can occur in any of the tissues in the radiotherapy field. In the treatment of laryngeal carcinoma, this includes the mandible, trachea and soft tissues of the neck. Radionecrosis usually manifests itself in the first year after treatment, although patients can present after longer periods of time.

Osteoradionecrosis of the mandible has an incidence rate of 0.4–56% after radiation therapy for head and neck malignancies [23]. The diagnosis is made on the basis of continuing radiologic evidence of necrosis within the radiation field in the absence of recurrent cancer [24]. Clinical diagnosis is made on the basis of observation of exposed bone that does not heal with conservative management over a period of weeks to months. Conservative treatment involves improved oral hygiene with saline irrigations, antibiotics and, in some cases, use of hyperbaric oxygen. Some patients require surgical treatment, which involves radical sequestrectomy and sometimes mandibular resection [23].

Osteoradionecrosis of the temporal and facial bones is thankfully rare. This challenging complication of radiotherapy can present as foul odour, epistaxis and headache, and if not recognized and treated, it can lead to meningitis, blindness and carotid artery haemorrhage [25].

**Conclusion**

Patients who have undergone a total laryngectomy can present to the emergency department with complications directly related to their previous surgery; however, they are also at risk for the same maladies and misfortune as the rest of the population. Understanding the treatment they have received and the unique needs that arise as a result of their treatment is paramount to ensuring that they are offered the same high-quality care as any other service user.

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**References**