*Head and Neck Surgical Complications*

Troy L Creamean, DO, FAOCO
ENT Associates of Corpus Christi
* To define the various complication associated with head and neck surgery.
* To review various head and neck surgeries and the associated complications.
* Occurrence rates.
* The time period in which the complications are most likely to happen.
* Tips for avoiding certain complications.
* Management techniques for various complications.

Learning Objectives
* A quote from Benjamin Franklin, “An ounce of prevention is worth a pound of cure.”

* This point has been emphasized by the renowned leaders and authors sharing their research and experience.
*Balloon sinuplasty? Not!
*These procedures are generally performed when oral and oropharyngeal tumors cannot be satisfactorily approached through the open mouth.

*D.M., Impaired nutritional status, poor dental hygiene, grossly infected teeth, prior radiotherapy, alcohol and tobacco use, and blood transfusion are risk factors for post operative wound infections and other complications.

*Pull Through, Visor Flap and Transmandibular Surgery
* Dubner and Spiro review in 1991 reported a total of 44% complication rate in 313 patients.
* 19% with exposed hardware, wound infection 14%, 11% with cardiopulmonary complications.
* With refinement in techniques over the past 30 years as an explanation, University of Alberta recently reported, wound infection rate 7.7%, 2.7% fixation failure in a study of 220 patients.
* Midline lip incision, leaving at least a 1-cm cuff on the mucosal incision, osteotomy location and shape (stair-step avoiding teeth), bone fixation technique with a very meticulous closure to avoid dead spaces are sighted through out the years as very important to minimize complications.

* Memorial Sloan-Kettering reported similar out comes with using either two small plates or a single larger plate.

* Important note is care while drilling the holes to avoid devitalizing teeth, irrigate to avoid thermal injury and leave no loose screws in at the time of surgery, either replace them with a safety screw or relocate them.
Fig. 15.1 Lip-splitting incisions for mandibulotomy (from left to right: lateral, median, circummental extension, chevron). (From Rapidis Valsamis S, Anterriotis DA, Skouteris CA. Functional and aesthetic results of various lip-splitting incisions: a clinical analysis of 60 cases. J Oral Maxillofac Surg 2001;59(11):1292–1296. Reproduced with permission from WB Saunders.)
Fig. 15.4 Depiction of midline stair-step mandibulotomy (red line), necessitating removal of a central incisor, but providing increased rotational stability and lengthened healing surface.
Fig. 15.6 Optimal placement of miniplates for fixation after mandibulotomy.
* Extract any cracked or loose tooth
* Local wound care with drainage of abscess if formed.
* If exposure of the hardware results in loose bony segment or hardware, then they should be removed along with any granulation, fibrotic or necrotic tissue should be removed. This helps decrease the risk of nonunion and then possible remedial plating can be accomplished.
* Late symptoms such as pain or temperature sensitivity can be remedied by hardware removal once bone healing is stable.

*Treatment of complications*
Exposed mandibular plate 3 years post operative mandibular resection
* Avoids a lip splitting incision and a mandibulotomy, but it has limited exposure to the tongue base.

* Meticulous layered closure.

* Devine et al from Glasgow compared the functional outcome in 150 patients with cancer and found comparable complications with the lip cutting approach.

* Though the Pull-Through group had significantly poorer speech, swallowing and chewing on the University of Washington quality-of-life assessment.

* The oral diaphragm is significantly compromised by the bilateral release that is not present in the lip cutting mandibular swing.

* Pull-Through Procedures
* Surgical Complications of the Larynx, Trachea and Hypopharynx

* Intubation injuries, complications and treatments.
* Tracheostomy complications.
* Laryngectomy complications.
* Cricotracheal resection and anastomosis complications.
There is no single examination or evaluation technique that reliably predicts difficulty with airway management and tracheal intubation.

The emergency room, pre-operative holding, operating room, post operative recovery, the hospital floors and intensive care units should all be well equipped with an airway management cart and emergency tracheostomy set.

Intubation and Emergency Airway
*In complicated HNS involving the airway, the anesthesiologist/CRNA and surgeon work together preoperatively to determine the severity of the situation.

*Preoperative preparation with optimization of the patient’s cardiovascular and pulmonary status by the respective specialists, a thorough H & P along with a team effort for a plan of action can avoid anesthetic complications.

*Having the support staff and appropriate equipment in the OR and ready before the patient arrives. The intubating scope, glide scope or awake tracheostomy set up with the staff and surgeon scrubbed in and ready to go if the airway is lost.

*Anesthesia Complications in Head and Neck Surgery
*Translaryngeal intubation or attempts at translaryngeal intubation can result in trauma and subsequent complications resulting from injury from the oral cavity down to the trachea.

*From cracked or fractured teeth, to a tooth as a foreign body in the airway, mucosal abrasion, cricoarytenoid joint dislocation, TVC hematoma, laryngotracheal tear as an initial trauma to complications from prolonged intubation. The complications are broadly classified as immediate/acute or late.

*MacEwen first described orotracheal intubation using a brass tube to administer anesthesia in 1878.
* Most commonly diagnosed by flexible laryngoscopy due to hoarseness, breathlessness, dysphagia and vocal fatigue after extubation.
* The affected side has a laxed focal fold, submucosal arytenoid hematoma with the most consistent finding of unequal level of the two vocal cords.
* Early repositioning at the time of diagnosis improves the likely hood of normal voice restoration.
* Prolonged dislocation leads to ankyloses and joint fixation.
* The joint repositioning in most commonly performed under general anesthesia via suspension microlaryngoscopy with repositioning posterolateral back into the facet.
This manifests within a few minutes of or up to a few hours after extubation.

Premature babies are more prone to develop this condition.

Treatment consists of conservative treatment with topical decongestants, IV steroids and reintubation with a one size smaller ETT. Then extubation in 2-4 days when there is a leak occurring around the ETT, preferably in the OR.

After a complete airway examination, a rational decision is made regarding the safety of continued reintubation or surgical intervention with a balloon dilation, Carbon dioxide laser, an anterior cricoid split or a tracheotomy tube placement or a combination.
Generally prolonged intubation is 7-10 days in adults and 2 weeks in children.

Santos et al., in 1994 reported complications from prolonged intubation of 13%.

In 1993 Benjamin classified stages of injury complications due to prolonged intubation: Vocal cord edema, Intubation granuloma, Cicatricial furrows, Interarytenoid scarring and Posterior Glottic Stenosis and Subglottic Stenosis.

Sequelae of Prolonged Intubation
* Most commonly presents weeks to months after extubation
* Most commonly with voice changes, globus sensation and rarely airway compromise.
* Most common site is the vocal process or the medial surface of the arytenoid.
* Common treatment is Carbon Dioxide Laser excision via suspension microlaryngoscopy.
* I personally like using the skimmer laryngeal blade of the Xomed/Medtronix microdebrider along with the 3mm rigid zero degree scope that is 25 cm long along with the HD camera instead of the microscope. I visualize the lesion with the scope through the suspension scope.
* Posterior ulcerative troughs seen after extubation.
* Often the cricoarytenoid joint and cricoid cartilage are exposed leading to chronic inflammation and ankylosis.
* Weeks to months after extubation these troughs heal and are noticed and named by Benjamin as cicatricial furrows.

*Cicatricial Furrows*
Fig. 16.7a–c Stenotic cicatricial sequelae due to prolonged endotracheal tube intubation.

a Posterior glottic stenosis without cricoarytenoid joint fixation.
b Posterior glottic stenosis with bilateral cricoarytenoid joint fixation.
c Cicatrical severe subglottic stenosis.
* Prolonged intubation is the most common cause of SGS in both adults and children.

* Surgical treatment by serial laser excision, balloon dilation, laryngotracheoplasty, laryngotracheal reconstruction or cricotracheal resection.

* Laryngotracheoplasty entails an anterior and posterior cricoid split with a laryngeal stent without a cartilage graft placed.

* Laryngotracheal reconstruction uses the same split and stent, but with the placement of a posterior and anterior cartilage graft.

* Cricotracheal resection is the treatment of choice for pure severe grade III and IV with > 70% SGS.
Ulceration crossing midline with no median residual strip of intact mucosa signifies a high risk for PGS formation. These patients present with range from DOE to near complete obstruction with a voice that is most often normal. There is a firm fibrotic posterior glottic scar between the arytenoid cartilages. Diagnosis of PGS from that of bilateral TVC paralysis is confirmed by outward movement of one of the arytenoids. This maneuver pulls the opposite arytenoid inward in PGS, but not in bilateral TVC paralysis.

**Fig. 16.4a–c** Acute intubation lesions:

- **a** Prominent edematous protrusion
- **b** Ulcerated troughs with exuberant posterior glottis.
- **c** Annular interarytenoid ulceration and granulation tissue in an immunologic diseased state.
Fig. 16.13a,b Single-stage partial cricotracheal resection (PCTR) for isolated grade III subglottic stenosis.

a Preoperative view: the grade III subglottic stenosis is away from the normal vocal cords.

b Postoperative view: patent subglottic airway 2 years after single-stage PCTR. The anastomotic line is barely visible posterolaterally under the left vocal cord.
Fig. 16.17a,b  Extended partial cricotracheal resection for glotto–subglottic stenosis with cicatricial fusion of the vocal cords.

a Preoperative view: acquired on congenital glotto–subglottic stenosis with fusion of the vocal cords and pinhole residual posterior opening.

b Postoperative view: patent glotto–subglottic airway, albeit with an overexpanded interarytenoid space. The posterior mucosal flap was sutured above the glottic level (white arrows).
The first tracheotomy was recorded in the sacred book of Hindu medicine, performed by Alexander the Great dated 2000 BC.

The vast majority of complications can be avoided by careful preoperative planning, attention to precise surgical detail and meticulous postoperative care.

Standard surgical tracheotomy (ST) and percutaneous dilatational Tracheotomy (PDT) complications are reported as similar, but interpreting the data is quite difficult due to uneven reporting of complications, uneven threshold for reporting of complications and inhomogeneity of techniques, patient subsets and performing surgeons giving misleading results.
* PDT and ST are often compared, yet the subset of patients are quite different.
* PDT patients are relatively homogeneous adult intubated in the ICU and are identified as high risk.
* ST patients are standardly neither intubated nor from the ICU.
* PDT are near always being performed by nonsurgeons, whereas virtually all ST patients are performed by surgeons.
* Complication rates in the literature vary widely from 4% to as high as 61% for PDT.
* Complication rates for ST in the OR is similarly reported with a wide range of 14 to 66%.
* Procedure related mortality (0.5-2%) is low for both groups.
Complications can be divided into intraoperative, immediate postoperative, and late postoperative complications.
* Desaturation-real risk is unknown d/t infrequently reported
* Hemorrhage- reported from 0-37% in ST and 1-19% for PDT
* Intraoperative tracheoesophageal fistula-rare in Both PDT and ST. Immediate layered repair is best in ST once the airway is secured. In PDT the needle is simply backed out.
* Pneumothorax- in ST usually due to a pretracheal false passage and PDT can be avoided by continuous Bronchoscopy while performing the procedure.
* Pneumomediastinum-most commonly seen on postoperative CXR in children, usually requires no treatment.
* Fire-rare, 100% preventable. Assure the surgical field is completely dry before electrocautery use and avoid alcohol based skin preps.

**Tracheotomy Intraoperative Complications**
* Tube obstruction-by thick mucus or blood clots.
* Displaced tube-usually due to inadequate length in obese patients, or due to excessive coughing or movement in agitated patients.
* Postoperative Hemorrhage-depending on the severity, it may be managed with topical application of surgicel or the patient may need to return to the OR for hemostasis.
* Wound infection is rare and aseptic technical care of the tube with sterile suctioning.
* Subcutaneous emphysema-usually no treatment is needed, use cuffed tubes and if the wound is packed, remove the packing to help release the air.

* Immediate Post-Tracheotomy Complications
* Granulation tissue-occurs reportedly in up to 80%, use non-fenestrated tube. Granulation tissue is increased if there is bacterial infection, GERD, if suture material is used and the powder from gloves.

* Tracheoesophageal fistula- can occur from and over inflated cuff, malposition, pressure against the wall with NGT in place, local infection and penetration of the posterior wall during insertion.

* Rupture of the innominate artery may be related to low of a tube placement, aberrant artery, to long of a tube eroding through the anterior tracheal wall, prolonged high cuff pressure causing erosion and localized infection.

* Tracheal stenosis and tracheomalacia.

* Tracheocutaneous fistula persistent after decannulation. (I repair with a donut inversion and an H advancement flap closure.)
*Hematoma/Seroma- vacuum failure from the drains at the stoma-skin suture. Easily corrected if identified immediately.

*Airway obstruction-mucus plugging or blood clots may be avoided with humidification and frequent suctioning following saline inspiration.

*Pharyngocutaneous fistula occurs up to 65% of laryngectomy patients. Risk factors include Hb < 125g/dl, previous tracheotomy, HX of RXTX and concurrent neck dissections.

*Tracheostomal stenosis occurs between 4-42%, higher incidence is noted in females and stoma infection.

*Pharyngeal Stenosis-dilation is usually effective. (minimum of 3 cm of mucosa to close, close over an NGT.)

*Peritracheostoma recurrence of cancer.

* Laryngectomy Complications
**Fig. 20.3** Small pharyngostoma opening superior to the tracheostoma.

**Fig. 20.5** Pharyngostoma with complete necrosis of the pharyngeal mucosa and neck skin from the tongue base to the esophagus entrance.

**Fig. 20.4** Large pharyngostoma with skin slough. A salivary tube is placed to avoid saliva exit to the neck.

**Fig. 20.6** Large skin necrosis after neck infection due to a pharyngocutaneous fistula at the tongue base (black arrow).

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**Tracheostomal Stenosis**

Stomal stenosis is a late complication after total laryngectomy, with an incidence that varies between 4 and 42%. A higher incidence has been associated with female sex.
* Recurrent Laryngeal Nerve Injury can occur unilateral, bilateral, temporary or permanently. Careful dissection with continuous identification and protection of the RLN along with judicious use of bipolar along with adrenaline sponges to minimize the need for bipolar cautery to lessen the risk of thermal injury.

* Post operative hemorrhage- attention to hemostasis as in other head and neck surgeries.

* Anastomotic Dehiscence- reported incidence ranges from 4-14% and requires a redo-anastomosis and a tracheostomy or Montgomery T-tube. Typical sign is persistent cough, stridor and sub-Q emphysema on POD 3-8. Visualization shows a clear gap between the two stumps.

* Anastomotic granuloma- most common complication and seen at the suture site of the anastomosis. Unless there is respiratory compromise due to the granuloma size requiring surgical intervention, they are best managed conservatively with steroids.

* **Cricotracheal Resection Complications**
* Defective wound healing
* Wound infections
* Dehiscence
* Scar hypertrophy
* Seromas, hematomas and sialoceles
* Salivary fistulas
* Anesthesia and paresthesia from greater auricular nerve injury
* Temporary or permanent partial or complete facial nerve paralysis
* Frey syndrome

*Salivary Gland Surgery Complications*
Fig. 22.1
Inadequate biopsy in a pleomorphic adenoma with the risk of tumor spillage. The skin around the biopsy has to be removed during definitive surgery.
* Immediate postoperative wound healing is associated with the development of hematomas, seromas and sialoceles.

* Postoperative hematomas associated with major salivary gland surgery is reported to be 3-7%. Removal of fluid collection

* Post parotidectomy skin flap necrosis is rare but associated risk factors include nicotine abuse, DM, previous RxTx. I’ve had two recently, both postauricular, conservative TX with close follow up and debridement. It is quite surprising how well they healed.

* Sialocele or fistula - attempts to drain a sialocele can lead to a fistula. Drains along with compression dressings tend to resolve most within 12 weeks. Botox and/or IMRT for protracted courses. I’ve probably performed close to 300 parotidectomies and 100 isolated submandibulectomies, and I can’t recall one sialocele or fistula.
Fig. 22.4 Surgical removal of a large hematoma after partial parotidectomy. The use of bare fingers may prohibit facialis nerve damage in the beginning.
Fig. 22.5 Necrosis of the skin flap after parotidectomy.
Greater Auricular Nerve Complications

* Complications reported at a rate of 57%.
* Symptoms abate and return to normal in 50% of the cases.
* Quality of life scale, although it be minor, showed overall, those patients whom had the GAN preserved during surgery had a better quality of life outcome score overall.
* GAN neuromas that develop may develop as a late complication that generally require resection to determine the diagnosis of neuroma verses recurrence.
* Temporary FN paresis is reported in the range of 18-65%
* Permanent FN paresis 0-19%
* Protect the cornea from damage d/t dysfunctional lid closure.
* Definitive surgical treatment should be held off until one full year, the nerve can regenerate up to that time period.
* Gold weight implants and static facial slings can help with lid closure and minimize drooling with repositioning of the oral commissure.
In 2004, Nitzan, et al. report an overall incidence of 57%.

Avoidance with closure techniques that include fat transposition/SMAS or placement of an allogeneic material between the parotid wound and subcutaneous tissue. No study has confirmed the long-term effectiveness.

Topical antiperspirant, glycopyrrolate have been used. Current treatment favors Botulinum toxin injections.
Fig. 22.11a–c Minor test.

a Frey syndrome after total parotidectomy. Minor test shows the skin regions (blue) of sweating.
b Skin marking and botox application in the areas of positive Minor test.
c Minor test 4 weeks after botox treatment. No visible gustatory sweating is present.

Fig. 22.12a,b Recurrences.

a Multiple recurrences of a benign pleomorphic adenoma in a 60-year-old male patient from Romania. He was operated on 30 years ago in his home country and again several years later. The facial nerve was already paretic. Though a benign disease, in this case radical surgery with removal of skin and tissue, together with a lateral thigh flap, had to be performed. Postoperative radiotherapy would have been useful in such a case.
b Recurrence of an undifferentiated salivary gland carcinoma after radical parotidectomy and chemoradiotherapy. A large edema of the orbit and free bone is visible. In this case, there was a clear indication for palliative therapy.
MuGurk et al published non-neural complications in 1,798 patients.
Hemorrhage 0-14%
Fistula 0-4%
Postoperative infection 0-14%
Altered skin sensation 0-16%
Scar formation 0-16%
Transient palsy of the mandibular branch of the facial nerve 9.6%
Permanent palsy of the same 3.3%
Transient palsies of the lingual and Hypoglossal: 1.9% and 0.5%
Permanent in both was reported at 1.5%
* Superior Laryngeal nerve injury is reported to range from 1-5%.
* Recurrent Laryngeal Nerve injury is reported in the range of 0.2-13.2%.
* Wound hematoma is 1%.
* Transient postoperative hypoparathyroidism is reported to range from 20 to 40%.
* Permanent hypoparathyroidism ranging from 2 to 5%.
* Wound infection < 0.5%.
* Tracheal injury is rare but more common in children.
* Tracheomalacia is rare and thought to be due to compression and softening from a large goiter.
* Horner Syndrome- damage to the sympathetic truck while dissecting around the carotid sheath is most common cause.

*Thyroidectomy Complications*
*Skin incision complications
*Locoregional infections
*Lymphatic vessel complications
*Chylothorax
*Lymphocele
*Blood vessel complications
*Peripheral Nerve complications
*Systemic complications.
* Wound dehiscence- a limited gap can be managed conservatively with secondary intention.

* Flap necrosis- if small can be treated conservatively with HBO to promote spontaneous healing.

* Potential major blood vessel or associated local infection- a well vascularized non-radiated flap to get neovascularization to protect the vessels and increased wound healing.
Fig. 25.5  Cutaneous dehiscence after surgery on a preirradiated neck. (Image courtesy of M. Bernal, MD.)
Fig. 25.6 Pharyngocutaneous fistula after surgery on an irradiated neck. (Image courtesy of M. Bernal, MD.)

Fig. 25.7 Local wound infection with partial necrosis after surgery on an irradiated neck. (Image courtesy of M. Bernal, MD.)
* Right lymphatic duct and left thoracic duct injury is reported at 1.5% on modified radical neck dissections and up to 3% in radical neck dissection this being under reported with the fact that overall chyle leaks are reported at 5.8%.

* 25% being reported to occur on the right side.

* Valsalva and identify and repair the leak if identified intra-op.

* If not identified until post operative, then conservative treatment for those <600ml/day. Treat with a no fat diet, Head above bed sleeping position, pressure dressing and removal of the suction drain. (for up to 30 days.) Reoperation can be troublesome, but feeding the patient heavy cream a couple hours pre-op facilitates localization. Closure with a local flap and fibrin glue can help to maximize success.
* Prompt repair of the CL if there is >600ml/day for several days

* Chylothorax - rare but can lead to massive pulmonary effusion and cardiopulmonary failure. Conservative therapy as described for CL. One or more thoracenteses or left thoracotomy drainage.

* Lymphocele is a late complication of a CL in the left supraclavicular region. This is usually treated conservatively, U/S guided needle aspiration with injection of a sclerosis agent, pressure dressing and low fat diet.

* Lymphatic Vessel Complications
Fig. 25.8a,b  Magnetic resonance contrast-enhanced T1 sequence on axial (a) and coronal (b) planes. Lymphocele appears homogeneously hypointense with no contrast enhancement. It is located at the confluence of the subclavian vein with the internal jugular vein, medially displaced, and posteriorly in contact with the anterior scalenus muscle.
* Internal jugular vein blowout
* Internal jugular vein thrombosis
* Venous congestion complications
*Calearo and Teatini reported in 1983 the incidence of IJV rupture after type III MRND at 0.8%.
*Contralateral loss after a RND can cause severe complications because of increased intracranial pressure.
*Complicated by fatal massive air embolism.

Combined injury of the IJV and subclavian vein brings on upper limb edema.

In bilateral neck dissections, I always do the contralateral neck dissection first to assure I can save the IJV.
Several studies have confirmed that this occurs up to 30% of MRND with 60-80% recanalization within 3 months.

Factors sighted for initiating thrombosis include complete mobilization from the clavicle to skull base, excessive traction, clot propagation from branch ligations, heat damage and drying of the vessel wall in long cases.

Other influencing factors include inadequate intraoperative blood volume, reduction of blood flow, hypotension during surgery and immediately post and cancer hypercoagulable state due to rise in factor VIII.

Compression by a bulky reconstruction flap, salivary fistula, wound infection and sepsis.

IJV thrombosis
* Unilateral IJV ligation leads to a transitory three-fold increase in intracranial pressure, where bilateral IJV occlusion creates 5 times higher than normal reported by Weiss et al., in 1983.

* Mortality from bilateral simultaneous RND is 14%, if staged at a month apart this decreases to 3%. Balm et al and Marks et al reported a total of six cases of permanent visual loss from intracranial pressure from bilateral RND.

* Amaurosis is treated with a lumbar drain and hyperventilation.

* Syndrome of inappropriate ADH secretion. Associated as well with increased intracranial pressure. If not promptly recognized and treated it can account for unexplained postoperative coma states.

* Venous Congestion Complications
* Embolus detachment from plaques.
* Cardiovascular changes due to manipulation of the carotid body that can lead to ventricular fib in digitalized patients.
* Intraoperative carotid artery rupture is rare
* Postoperative carotid artery rupture has been reduced from older studies, recently reported up to 1.2%.
* Factors leading to carotid artery blowout include RND, RT or CRT, cervical flap necrosis with wound dehiscence or tumor recurrence.
* MM branch of CNVII paralysis reported temporary up to 29% and permeant 2.6% in MRND.
* CN X- rare, but when occurs it has associated dyspnea, dysphonia, dysphagia, ineffective cough and aspiration pneumonia.
* CN XI- sequela of a RND, shoulder dysfunction, Shoulder syndrome
* CN XII- incidence reported of 1.69% in MRND.
* Cervical Sympathetic Chain- Horner’s Syndrome- ptosis, miosis, enophthalmous and anhidrosis.
* The prevalence of phrenic nerve injury in RND is 10-11%
* Lung atelectasis
* Bacterial pneumonia
* Pulmonary embolism
* Pneumothorax
* GI bleed/stress ulcers
* Acute pancreatitis
* MI
* CVA

**Systemic Complications of RND**
BCCA and 1 month post op