HOW I DO IT

Near-total Laryngectomy

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Abstract

Dr. Bruce Pearson described near-total laryngectomy (NTL) in 1981[1] a procedure which creates a biological shunt between the airway and the neopharynx to restore speech. Unlike other biological shunts, this is a dynamic myomucosal shunt which has universal applicability as seen by various series published from around the world.[2-11] We feel that the NTL procedure is oncologically safe and can provide a serviceable, prosthesis free voice and should be considered as a sound treatment option in advanced but lateralized cancers of the laryngopharynx. NTL has been described extensively in literature but we would like to highlight in this technical note a few modifications which we have found to be suitable and easily applicable by surgeons who regularly perform a total laryngectomy. We feel strongly that each and every surgeon who intends to treat laryngopharyngeal cancer should be well versed in this technique. A NTL shunt performed in a suitable patient gives the ability to phonate at will and makes the patient independent of a medical professional since the shunt is permanent and maintenance free.

Keywords: Larynx, Hypopharynx, Cancer, Near-total laryngectomy.

INTRODUCTION

Near-Total laryngectomy is a procedure described by Dr. Bruce Pearson from the Mayo Clinic way back in 1981.[1] The procedure was a brilliant method to create a biological shunt between the airway and the neopharynx to restore speech. Unlike other biological shunts, this was a dynamic myomucoal shunt. All it required was that the disease in the laryngopharynx should be lateralized and it should be possible to save an innervated cricoarytenoid unit with two-thirds of the vocal cord. The NTL shunt is biological (utilising patients remnant cricotracheal mucosa and true cord) and dynamic (prevents aspiration due the resting closed state of the shunt opening). This was a real improvement over other biologic shunts. Its universal applicability is seen in the various surgical series published from all parts of the world[2-11] The world finally got a biological shunt which could be easily reproduced by any surgeon and once successful would remain maintenance free for the patient with voicing as good if not better than that of the prosthetic shunt (Fig. 1).

We feel the NTL procedure has a lot of potential to provide an oncologically sound procedure with a serviceable voice, even in this era of concurrent chemoradiation in advanced but lateralized cancers of the laryngopharynx. Not all patients can withstand the intense treatment of three weekly chemoradiation and then there are patients who will require salvage surgery. Therefore, it remains incumbent on the surgeon to meticulously map the lesion prior to any treatment so that voice preserving surgical option can be offered to the patient when other modalities are found inappropriate or fail. Direct laryngoscopy remains the most important tool in the management of the cancer of the laryngopharynx.

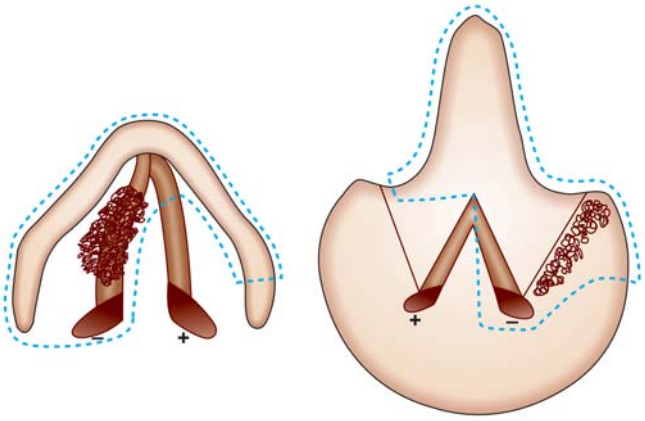

Fig. 1: Mucosal cuts in glottic and hypopharyngeal cancers

NTL has been described extensively. What we would like to highlight in this technical note are few modifications

which we have found to be suitable and easily applicable by surgeons who regularly perform the total laryngectomy. We feel strongly that each and every surgeon who intends to treat laryngopharyngeal cancer should be well versed in this technique. A NTL shunt performed in a suitable patient gives the ability to phonate at will and makes the person independent of a medical professional since the shunt is permanent and maintenance free.

INDICATIONS

The near-total laryngectomy is designed for advanced laryngopharyngeal cancers where the cord is fixed and there is laryngeal framework involvement. The disease should be however lateralized and not involve the central laryngeal framework. Thus, an advanced glottis cancer may destroy the thyroid cartilage but the interarytenoid tissue should be free of disease. In an advanced supraglottic or hypopharyngeal cancer, the disease should not enter the postcricoid mucosa.

Contraindications

Presence of edematous tissue in the interarytenoid region or the postcricoid region or any obvious disease at those sites.

PROCEDURE

Most steps in the process of near-total laryngectomy are similar to that of a regular laryngectomy. In management of head and neck cancers, we need to address the draining lymph nodes and the primary tumor.

Neck Dissection

Since NTL is being performed on a stage III or IV patient, it is mandatory to do a minimum of bilateral anterolateral neck dissection to clear lymph node levels II-IV in a clinically node negative patient and a clearance in addition of lymph nodes at level V in those with clinically obvious lymph node involvement.

Near-Total Laryngectomy

In a patient satisfying the criteria of uninvolved interarytenoid and postcricoids mucosa, the larynx is opened carefully taking care that whilst the tumor is removed with oncologic principles the uninvolved larynx, i.e. at least two-third of the vocal cord, the cricoarytenoid unit and the contralateral recurrent laryngeal nerve (RLN) is preserved. Thus, all the steps are carried out with the objective of visualizing the interarytenoid and postcricoid mucosa and preserving contralateral inferior cricothyroid joint and the RLN.

DIVIDING THE INFRAHYOID STRAP MUSCLES

The larynx is devascularized on the side of the disease by ligating the superior thyroid artery and its branch the superior laryngeal artery as well as the inferior thyroid artery. The sternohyoid and the sternothyroid muscles are divided on the ipsilateral side at the sternal heads. Care is taken to preserve these straps on the contralateral side. The ipsilateral thyroid gland is divided at the isthmus and kept attached to the larynx. This exposes the tracheal rings for airway transfer.

EXPOSURE OF THE HYOID AND THYROID CARTILAGE

The sternohyoid muscle is divided at the hyoid bone on both sides. The strap muscles get reflected down on the contralateral side exposing the thyroid cartilage after separating the sternothyroid muscle from the oblique line.

AIRWAY TRANSFER AND LARYNGEAL ENTRY

The tracheostomy is then done at a predetermined level. Care is taken to ensure that there are at least two rings above the stome so that the skin can be matured to a tracheal cartilage. Also longer the length of the cricotracheal mucosal shunt, better is the speech. In a patient who does not have a tracheostoma, the trachea is incised between the third and fourth ring. Eventually, the third tracheal ring is excised allowing the creation of a good tracheostoma.

The laryngeal entry is now done as in a routine laryngectomy, i.e. transvallecular. This is a modification of the original Pearson procedure, which recommended a trans-ventricular entry on the contralateral side (Figs 2 and 3). We believe this modification is better suited for our lesions which are largely supraglottic and hypopharyngeal allowing us better vision for the margins. Also it is similar to that in a total laryngectomy which makes it easier to explain and follow.

Fig. 2: Proposed cuts on the laryngeal skeleton

Fig. 3: Transvallecular laryngeal entry

INSPECTION OF THE MIDLINE LARYNGOPHARYNGEAL MUCOSA AND THYROID CARTILAGE DIVISION

Once the disease has been inspected, steps are taken to expose the laryngeal framework to ensure oncological sound clearance of the disease. The superior thyroid lamina of the contralateral thyroid cartilage is incised and the inner perichondirum elevated. The thyroid cartilage is now incised preserving its posterior lamina where the pharyngeal muscles are inserted ensuring that the inferior cricothyroid joint is not disturbed preventing damage to the RLN at its entry into the larynx. This step is very important to prevent a non-functional shunt.

MUCOSAL CUTS CIRCUMSCRIBING THE DISEASE

The larynx rigid skeleton is now suitably lax to allow soft tissue resection without compromise. The mucosal incision is begun at the contralateral pharyngoepiglottic fold as close to the epiglottis as possible and down reaching the ary-epiglottic fold. At the point we have to ensure that maximum ary-epiglottic mucosa is preserved whilst removing the entire pre-epiglottic space along with the epiglottis. The incision now traverses the false vocal cord and reaches the true vocal cord close to the anterior commissure. Using a 11 number blade sharply divide the true cords ensuring at least two-thirds of the cord is preserved. The incision now passes through the paraglottic space on the contralateral side and comes on to the cricoid cartilage. The cricoids cartilage is now divided in midline and the mucosal cut goes through the cricothyroid membrane all the way to reach midline on the ipsilateral side (Fig. 4).

CRICOID CARTILAGE DIVISION IN MIDLINE

The mucosal cuts are taken incising the interarytenoid region coming on the cricoid cartilage (Fig. 5). The cricoids cartilage is bent and it cracks easily. The mucosal cuts are then taken through the ipsilateral pharyngeal mucosa whilst resecting a pyriform disease. In a glottic disease, the mucosal cut is extended just a little onto the postcricoids mucosa and the cricoid cartilage is elevated by subperichondrial elevation preserving the ipsilateral pyriform as well.

PREPARING THE CRICOTRACHEAL MUCOSA FOR THE SHUNT

The specimen is removed and the preserved structures evaluated. The RLN, the arytenoid cartilage and the length of the true vocal cord are inspected. The true vocal cord should be adequate to form a shunt by suturing it to the interarytenoid region. If this is short then augmentation of the mucosa is done with help of the pyriform sinus mucosa. The next step is to mobilize the cricotracheal mucosa to

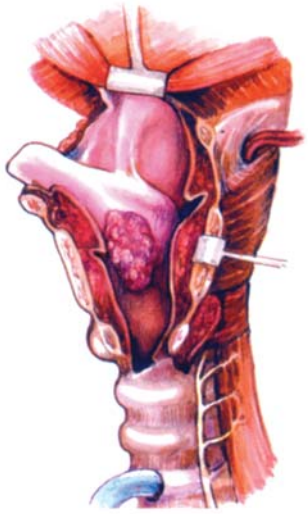

Fig. 4: Exposure and inspection of the lesion

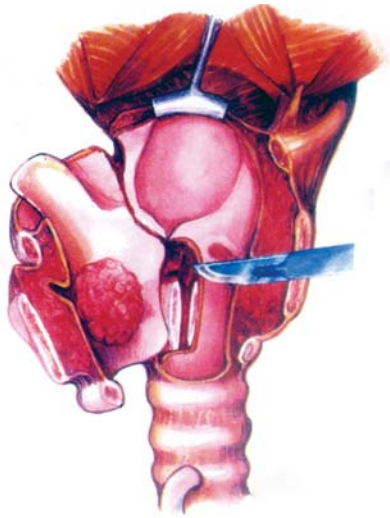

Fig. 5: Mucosal cuts in interarytenoid region

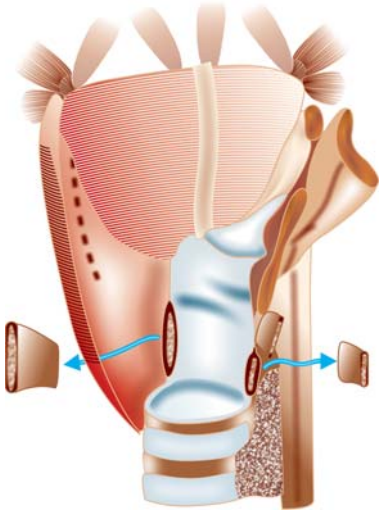

Fig. 6: Removal of cricoid cartilage in preparation of shunt

form the shunt. For this purpose, the mucosa is elevated by subperichondrial dissection off the cricoid cartilage adequately and then resecting the cricoid cartilage (Fig. 6) preserving the cricoarytenoid joint region. This allows the mucosa to be sutured to form the shunt.

NEAR-TOTAL SHUNT CREATION

The 1st tracheal cartilage is divided in midline by excising a small wedge. This facilitates the formation of the shunt. This is a modification from the original Pearson procedure. The shunt is now sutured over a red rubber catheter of 12Fr to ensure that 30 to 40 mm of H_2O pressure is generated to produce an intelligible and sufficiently loud speech.[12] The catheter is placed from the tracheostome to the interarytenoid region. The shunt suturing is done over this catheter. This ensures the shunt being of adequate diameter and prevents generous mucosal bites with the needle whilst suturing which can lead to a narrow shunt and subsequent shunt stenosis (Fig. 7). The shunt closure is done with simple interrupted sutures using absorbable material made from polyglycolic acid (Vicryl®). The mucosal edges are brought together carefully and at the level of the true cords the thyroarytenoid muscle is sutured to the interarytenoid muscle. This creates a sphincter which remains closed during swallowing and opens only during phonation, thus preventing aspiration. If the shunt is too wide at the level of the arytenoid, it can result in aspiration. While creating the shunt ensure that:

1. The cricotracheal mucosa has no lacerations (Fig. 8).
2. The edges are clean
3. The suturing is done over a catheter to create an adequate diameter shunt

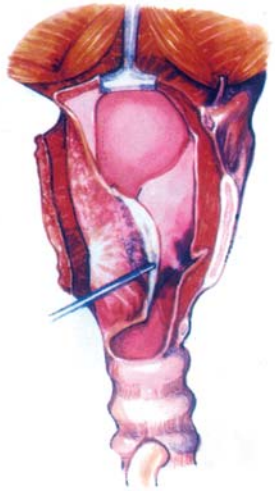

Fig. 7: Assessing the shunt diameter

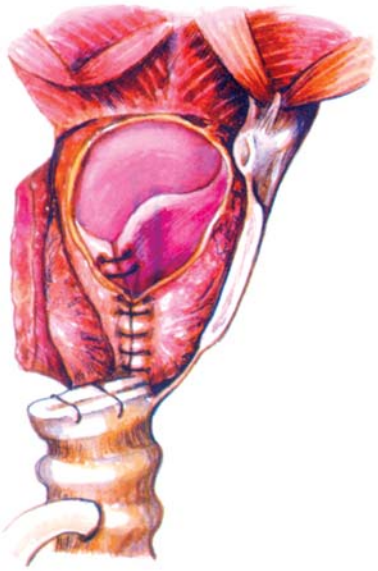

Fig. 8: Suturing the cricotracheal mucosa to form the shunt

Fig. 10: Approximation of the infrahyoid straps to the suprahyoid straps

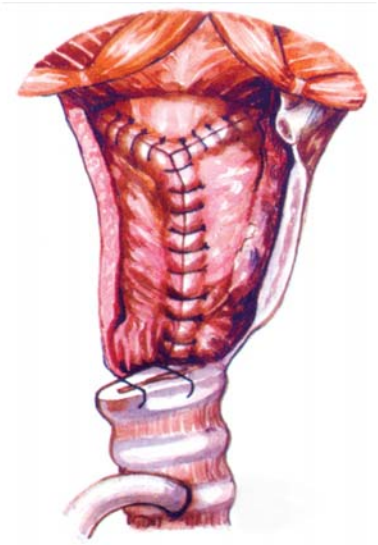

Fig. 9: Neopharyngeal closure invaginating the shunt

4. The thyroarytenoid is sutured to the interarytenoid muscle to form a sphincter

The catheter can be removed once the neopharynx is sutured to ensure that the shunt is invaginated into it properly (Fig. 9).

NEOPHARYNX

After the shunt is created, the neopharynx is formed by suturing the edges of the remnant pharyngeal mucosa. The pharyngeal mucosa is measured and only if it is adequate, i.e. more than 3 cm of unstretched mucosa then a primary closure of the pharynx undertaken.

Augmentation of the pharyngeal remnant can be done with pectoralis major myocutaneous flap (PMMC) or a free forearm radial artery based fasciocutaneous flap. Augmenting the pharynx bears no relation on the outcome of the voicing. The shunt is independent of the neopharynx.

The precautions to take are at the point where the shunt invaginates into the pharynx. This is the weakest point in the suture line and needs to be buttressed. The base tongue is usually unsupported in any pharyngeal closure due to the vallecular mucosa. It is imperative to suture the myelohyoid over it followed by the pharyngeal muscles with the suprahyoid straps. In the NTL the contralateral straps, which are preserved are now brought together with the suprahyoid straps and it ensures that the shunt is supported (Fig. 10).

MATURING THE TRACHEOSTOME

The tracheostome in NTL is a side stome unlike in a total laryngectomy (Fig. 11). To ensure that the tracheostome does not stenose we have to ensure that a tracheal ring is removed. This is usually the third ring. The cartilage should not exposed and always be covered with tissue which will prevent chondritis. The skin should be sutured properly so that it covers the cartilage. The posterior membranous wall of the trachea is intact and continues above with the shunt. The cartilage and mucosal junction of both the upper and lower tracheal rings is stretched to ensure that the tracheal lumen is maintained.

Postoperative Care

Stoma should be carefully cleaned and adequately lubricated with liquid paraffin to avoid crusting. In short stocky

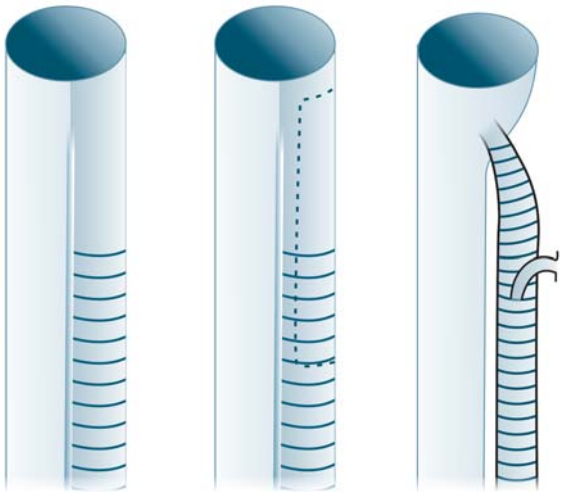

Fig. 11: Relation of the shunt to the neopharynx and the side tracheostome

individuals care should be taken to ensure that the stoma is kept patent. The upper tracheal rings can fold downward in supine position and these patients might require tracheostomy tube till they are mobile.

Oral Intake and Voicing

The near-total laryngectomy has a potential for leak due to the invagination of the shunt into the neopharynx. We usually start the patient on oral liquids after 12 to 14 days. Look out for aspiration, especially checking the posterior tracheal wall for any wetness, which suggests salivary aspiration. Usually this settles down once the patient is swallowing normally.

Voicing is initiated after three weeks. The stoma is occluded and the patient is instructed to cough. This forcible blast of air is required to clear the retained secretions and crusting. The patient is then asked to phonate single words usually numbers. He is then counselled for speech progressing from single words to sentences, step by step building lung power and developing control over their breathing.

CONCLUSION

Near-total laryngectomy is an oncologically sound procedure which creates a biological shunt which is dynamic and maintenance free. Once functional, it gives the patient an almost natural voice without problems of prosthetic shunt which are recurring cost and doctor dependence. This procedure needs to learnt and developed by all our praticising head and neck surgeons to give the suitable patient a chance of independent existence.

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