

TOTAL LARYNGECTOMY

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STEP 1 INCISION AND POSITION OF STOMA

A superiorly based apron flap incision is marked with the horizontal limb placed about 2 cm above the clavicles with the vertical limbs parallel to and 1 cm posterior to the anterior borders of the sternocleidomastoid muscles (SCM).

The stoma is marked immediately below the horizontal limb so that its future upper border will be the apron flap. The size of the stoma should approximate the size of the patient's thumb to facilitate the use of a voice prosthesis, or be about 1.5 times the diameter of the trachea. The lower border of the stoma should be 2 cm above the upper border of the manubrium. It is important not to place the stoma too low in the neck, especially when the neck is already extended for surgery. **Figures 1, 2**

Musculocutaneous flaps are elevated in

the subplatysmal plane to 2 cm superior to the hyoid bone above, and to the sternal notch below.

STEP 2 RETRACTION OF THE SCM AND DIVISION OF OMOHYOID MUSCLE

Incise the investing layer of deep cervical fascia along the anterior border of SCM and divide the external jugular vein/great auricular nerve if necessary.

Retract the SCM laterally and then dissect on the medial surface of the SCM from medial to lateral and anterior to posterior to expose the omohyoid muscle and internal jugular vein (IJV). The segmental blood supply to the SCM is cauterized with bipolar diathermy and then the belly of the omohyoid muscle is divided. With gentle retraction on the IJV, the middle thyroid vein is divided between clamps

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and ligated. The internal jugular vein and the lateral border of sternohyoid muscle are clearly defined at this stage. **Figure 3**

STEP 3 DIVISION OF THE INFRAHYOID MUSCLES

Divide and ligate the anterior jugular vein. The sternohyoid strap muscle is exposed in and just above the sternal notch. The sternohyoid muscle and then deep to it the sternothyroid muscle are divided with diathermy to expose the thyroid lobe medially and the IJV laterally beneath them.

STEP 4 REPEAT STEPS 2 & 3 ON THE CONTRALATERAL SIDE

Repeat steps 2 and 3 on the contralateral side so that both thyroid lobes are exposed. The contralateral (the side with-

out larynx cancer) thyroid lobe can usually be preserved to avoid hypocalcaemia and hypothyroidism if there is no gross tumour invasion into the thyroid gland on imaging.

STEP 5 PRESERVATION OF ONE THYROID LOBE

The thyroid isthmus is divided and oversewn with a suture.

The contralateral thyroid lobe is mobilized from the trachea and rotated laterally to free it from the larynx. The recurrent laryngeal nerve can be identified in the tracheo-oesophageal groove, but the nerve is obviously cut in a total laryngectomy. The oesophagus should be identified and preserved. The superior laryngeal artery is divided from the superior thyroid artery which is preserved to maintain blood supply to the thyroid lobe.



Figure 1
Apron incision and the stoma

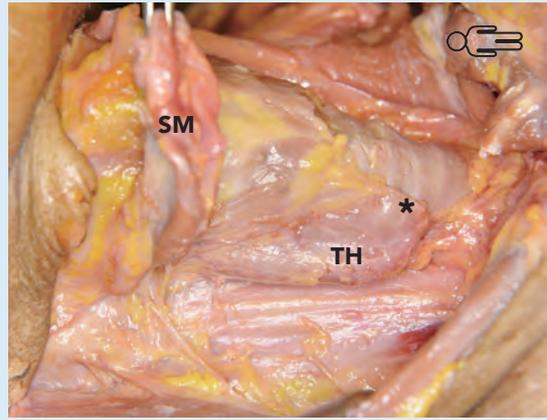


Figure 4
Strap muscle (**SM**) dissected free from the right thyroid lobe (**TH**) and isthmus (*) divided



Figure 2
Alternative incision with stoma away from the main incision

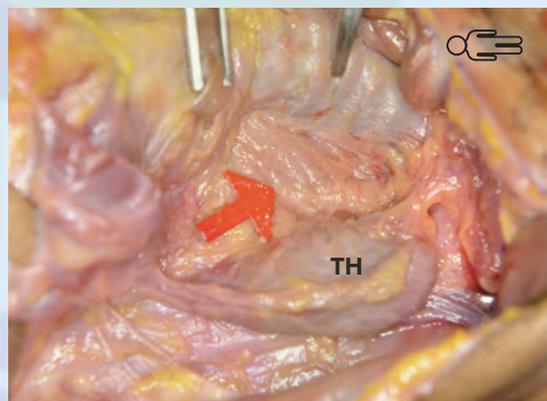


Figure 5
Thyroid (**TH**) mobilized from the laryngeal frame work and the oesophagus (red arrow) is exposed

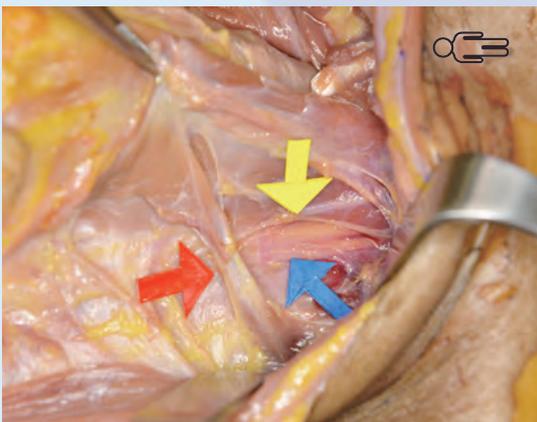


Figure 3
SCM retracted to expose the omohyoid muscle (red arrow), IJV (blue arrow) and free edge of sternohyoid muscle (yellow arrow)

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The ipsilateral (the side with larynx cancer) thyroid lobe is left attached to the larynx as an additional margin and the recurrent laryngeal nerve, superior thyroid artery and inferior thyroid arteries are divided to free up the larynx. Care must be taken once again to identify and preserve the oesophagus.

The superior laryngeal nerve is identified before it penetrates the thyrohyoid membrane and is divided on both sides.

Figures 4-6

STEP 6 SEPARATING THE CONSTRICTOR FROM THE THYROID CARTILAGE

The larynx is rotated to the contralateral side and the posterior border of thyroid ala is palpated. The attachment of the inferior constrictor muscle at the oblique

line on the thyroid cartilage is incised and the constrictor muscle together with the perichondrium is stripped off from the thyroid cartilage. The mucoperiosteum continues to be stripped off from the lateral wall of the pyriform fossa (strip it off from the medial aspect of the thyroid ala in a subperichondrial plane with a swab or sponge held over a fingertip, or with a Freer's elevator). If the tumour extends into the hypopharynx, this step is omitted to ensure adequate resection margins. The same procedure is repeated on the other side. **Figures 7, 8**

STEP 7 RELEASING THE HYOID BONE SUPERIORLY

The hypoglossal nerve which is deep to the greater cornu of the hyoid bone must be identified and preserved on both sides. The muscles attaching to the

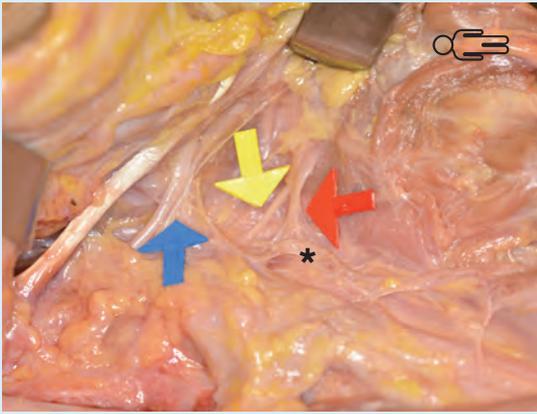


Figure 6

Hypoglossal nerve (blue arrow), superior laryngeal nerve (yellow arrow) and the superior laryngeal artery (red arrow) arising from superior thyroid artery (*)

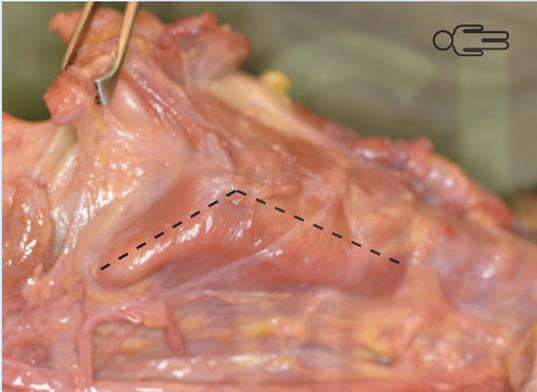


Figure 7

Incise at the oblique line (indicated above) to divide the inferior constrictor muscle

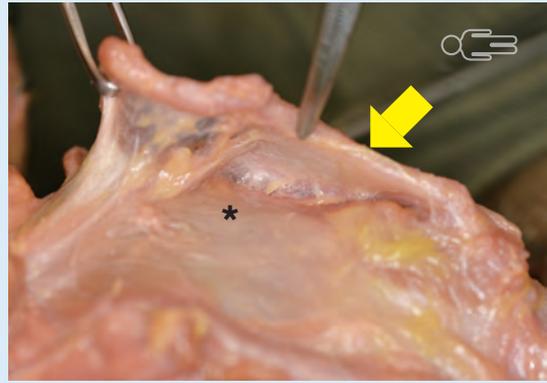


Figure 8

Piriform fossa mucosa (*) dissected free from the thyroid cartilage (yellow arrow)

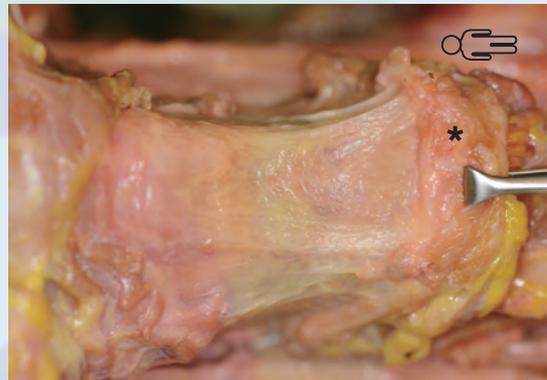


Figure 9

Suprahyoid myotomy with Allis tissue forceps holding the hyoid bone (*)

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superior surface of the body of the hyoid are divided using cautery with the tip of the cautery in contact with the superior border of hyoid bone to avoid injury to the hypoglossal nerve. The stylohyoid ligament is divided from the lesser cornu of the hyoid bone to further mobilize the bone. Rotate the hyoid bone to the contralateral side to identify the greater cornu. Using scissors divide the soft tissue on the medial and posterior aspect of the greater cornu of the hyoid to isolate the greater cornu on both sides. Keeping the tip of the scissors on the hyoid bone will prevent the hypoglossal nerve from being inadvertently cut. Further dissect transversely with diathermy along the superior margin of the hyoid bone and then into the superior aspect of the pre-epiglottic space. Identify the hyo-epiglottic ligament in the midline. Dissect superiorly along the hyo-epiglottic ligament to the epiglottis and then strip the vallecula mucosa from the anterior

surface of the epiglottis. The tip of the epiglottis is identified through the mucosa and is readily grasped with an Allis tissue forceps. The pharynx is entered by incising into the mucosa along the superior free edge of the tip of the epiglottis if the pharynx is to be entered from above.

Figure 9

STEP 8 DIVISION OF THE TRACHEA

Just prior to entering the pharynx, the trachea should be transected between tracheal rings 2 and 3. Do not cut through tracheal cartilage but divide cleanly between 2 tracheal rings. **Figure 10** The oro-tracheal or nasotracheal tube is withdrawn and the trachea re-intubated through the neck wound. Make sure to divide the posterior tracheal wall at least in the same plane as the tracheal rings by dividing the posterior wall higher than

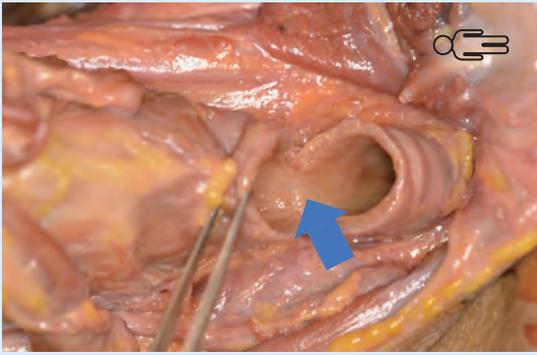


Figure 10

Trachea (blue arrow) transected between 2 tracheal rings

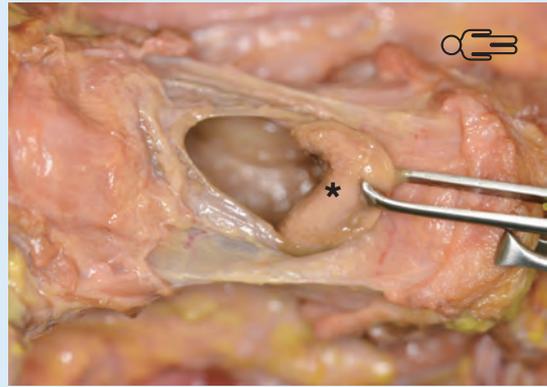


Figure 11

Epiglottis tip (*) grasp with Allis tissue forceps

you imagine you should. The posterior tracheal wall should be slightly longer than the anterior tracheal wall as this aids in fashioning the stoma.

STEP 9A ENTRY INTO THE PHARYNX FROM ABOVE

Grasp the tip of epiglottis with Allis tissue forceps through the thin mucosa. The pharynx is entered in the midline at the tip of the epiglottis and the pharyngeal incision is continued on the opposite side to the tumour by hugging the lateral margin of the epiglottis.

On the non-tumour side, the mucosa of the pharynx is divided from its attachment to the larynx by dividing the mucosa of the medial pyriform fossa under vision. The larynx can then be rotated to bring the tumour into view.

On the tumour side and under full view, the mucosa of the pyriform fossa is divided with adequate 1-2 cm margins to separate the larynx from the pharynx laterally.

The inferior aspect of the left and right pyriform fossa incisions are joined by tunneling between the cricopharyngeus and the trachea on each side and then dividing the postcricoid mucosa and cricopharyngeus transversely. The laryngeal specimen is delivered from the wound at this stage. **Figures 11, 12**

STEP 9B ENTRY INTO THE PHARYNX FROM BELOW

Develop the avascular plane between the trachea and oesophagus and separate the upper stump of the trachea from the oesophagus. Do not separate the lower trachea from the oesophagus. Bilateral crico-arytenoid muscles and the post

CLOSURE OF PHARYNX

cricoid mucosa will gradually be exposed. The pharynx is entered by incising into the post cricoid mucosa from the midline and once the pharynx has been punctured, the pyriform fossa mucosa opposite to the tumour is divided with scissors to expose the hypopharynx and larynx. The larynx is mobilized by completing the mucosal incision across the vallecula and the ipsilateral pyriform fossa with adequate margins. The laryngeal specimen is delivered from the wound at this stage.

Figures 13, 14

STEP 10 CLOSURE OF PHARYNX

A watertight seal is essential and is achieved with a meticulous, multilayered closure. A feeding tube should be placed and hemostasis assured prior to inserting any closing sutures. The initial layer of closure is a running Connell stitch using 3-0

Vicryl. One suture with needle attached should be anchored at the inferior portion of the pharyngotomy, just above the oesophagus. Closure begins with the inferior suture proceeding superiorly. The pharynx can be closed in either a straight line or T- fashion. **Figures 15, 16**

The second layer is achieved with interrupted sutures. This closes the fascia over the incision line again using 3-0 Vicryl. In the third and final layer of closure, sutures are used to close either constrictor muscle or strap musculature over the incision line.

STEP 11 FASHION THE STOMA

The final portion of the laryngectomy is completion of the tracheostoma. The inferior border is addressed first and sutures of 2-0 nylon are used. The stitch is placed through the skin and then from outside to inside the tracheal lumen



Figure 12

The larynx rotated to bring the tumour into view, Oesophagus (*)

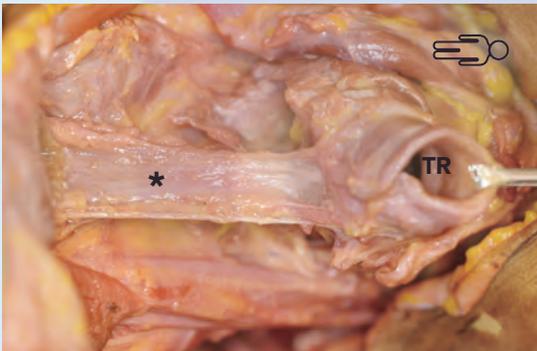


Figure 13

Develop the avascular plane between the trachea (TR) and oesophagus (*)

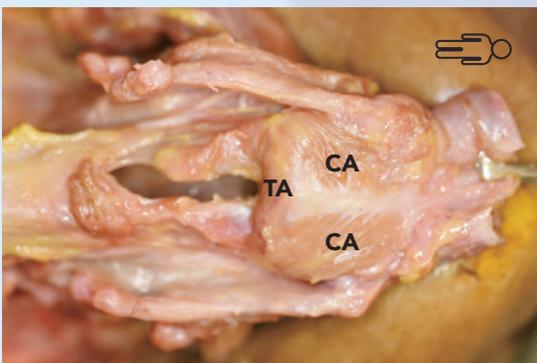


Figure 14

Post cricoid mucosa cut open providing entry to the larynx, crico-arytenoid muscle (CA) and Transverse arytenoid muscle (TA)

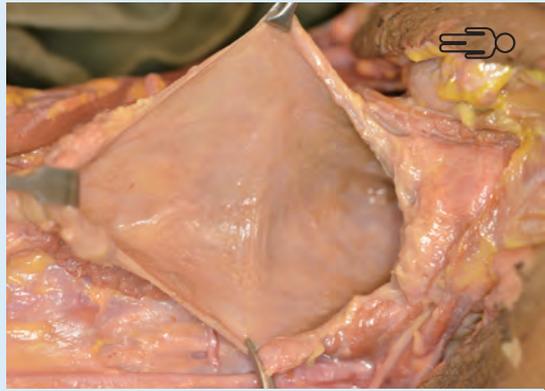


Figure 15

Preserved pharyngeal mucosa wide enough to avoid dysphagia after primary closure

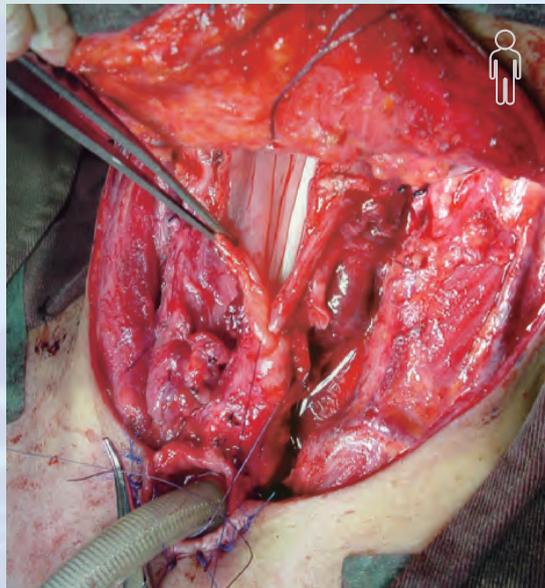


Figure 16

Closure of pharyngeal mucosa using running Connell suture

WOUND CLOSURE AND FASHION THE STOMA

just below a tracheal ring. The suture is then passed back through the skin from subcutaneous to external, just horizontal to the initial entry point. In this manner a half mattress is formed for the tracheal part of the stitch around the tracheal ring thus lending strength to the stoma. **Figure 17**

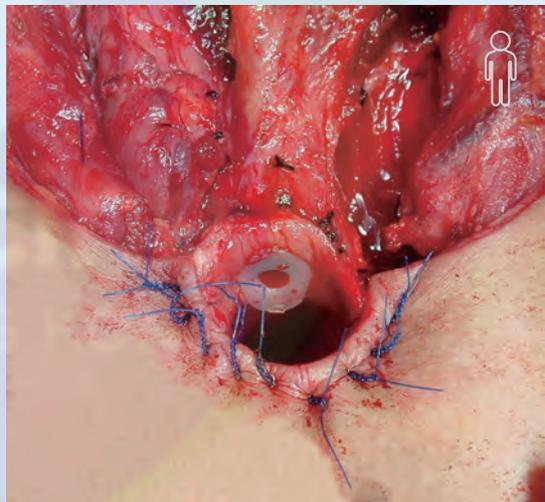


Figure 17.

Stoma fashioned with half mattress sutures
Note placement of tracheo-oesophageal valve

KEY POINTS

1. Mark a superiorly based apron flap with the horizontal limb placed 2 cm about the clavicles.
2. Do not to place the stoma too low in the neck by ensuring the lower border of the stoma is 2 cm above the upper border of the manubrium.
3. After raising the flaps, retract the SCM and divide the omohyoid muscle and middle thyroid vein.
4. Divide the infrahyoid muscles to expose the thyroid lobes.
5. Preserve the contralateral (the side without larynx cancer) thyroid lobe to avoid hypocalcaemia and hypothyroidism, if it is not invaded by tumour.
6. The inferior thyroid artery is preserved, as is the superior thyroid artery by dividing the superior laryngeal artery from it.
7. The hyoid bone is released superiorly from all attached tissues while preserving the hypoglossal nerves.
8. The trachea is divided cleanly between tracheal rings and the posterior tracheal wall is divided in the same plane.
9. The pharynx is entered either superiorly or inferiorly and the larynx separated from the pharynx under direct vision sparing as much normal pharyngeal mucosa as is oncologically feasible and safe.
10. Use a Connell suture to achieve water tight closure of the pharynx and half mattress sutures to fashion the stoma.