

Cricopharyngeal myotomy may be indicated for cricopharyngeal spasm causing dysphagia or aspiration and is done in patients undergoing external resection of a pharyngeal pouch / Zenker's diverticulum (ZD).

Cricopharyngeal dysfunction / achalasia may be *primary or secondary*. **Primary achalasia** refers to persistent spasm or failure of the cricopharyngeus to relax, where the pathology is confined to the muscle and there is no underlying neurologic or systemic cause. It may be idiopathic or be associated with intrinsic disorders of the muscle *e.g.* polymyositis, muscular dystrophy, and hypothyroidism. Cricopharyngeal spasm may be *secondary* to neurologic disorders *e.g.* poliomyelitis, oculopharyngeal dysphagia, stroke, and amyotrophic lateral sclerosis (ALS), or diabetic neuropathy, myasthenia gravis, and peripheral neuropathies.

The diagnosis is made on history and contrast swallow (videofluoroscopy). The contrast swallow typically shows a prominent bulge in the posterior wall of the proximal oesophagus due to contraction of the cricopharyngeus muscle (*Figure 1*). *Figure 2* shows spasm of the cricopharyngeus muscle causing dysphagia and regurgitation.

The myotomy is commonly done via an external approach, although an endoscopic approach using CO₂ laser can also be employed. Alternative treatments include dilations and Botulinum toxin injections.

Cricopharyngeal myotomy is also done in patients undergoing external resection of a **pharyngeal pouch**, as elevated cricopharyngeus muscle tone is considered a cause of a ZD.

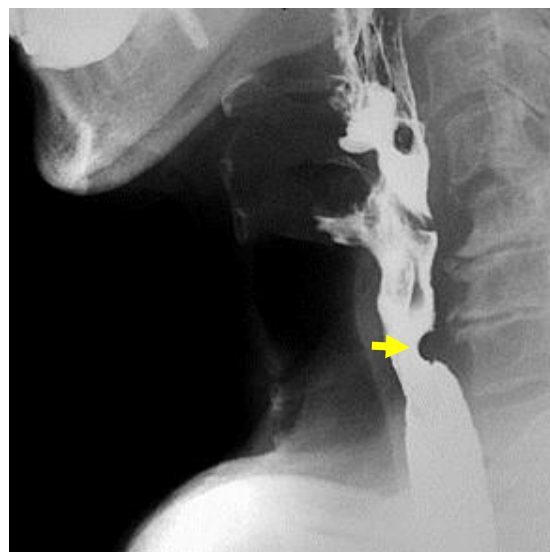


Figure 1: Note cricopharyngeal bar



Figure 2: Spasm of cricopharyngeus muscle causing dysphagia

With endoscopic diverticulotomy, the cricopharyngeus muscle is divided when cutting through the wall between the ZD and the oesophagus (*Figure 3-5*). [See chapter on Zenker's Diverticulum](#). Cricopharyngeal myotomy may also be done in isolation for very small ZDs (*Figure 6*).

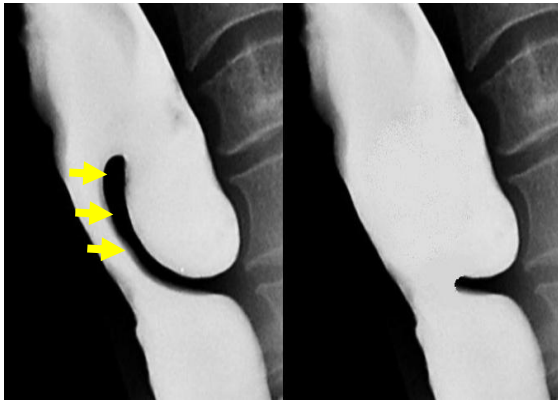


Figure 3: Contrast swallow before and after endoscopic diverticolotomy: Cricopharyngeus (yellow arrows) and the party wall between the ZD and the oesophagus are divided

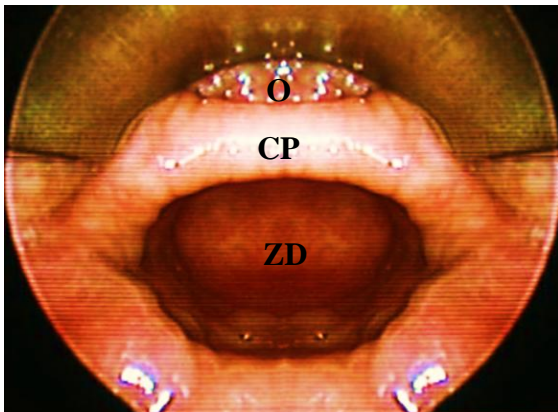


Figure 4: Cricopharyngeal bar (CP) containing the cricopharyngeus muscle, which separates oesophagus (O) from ZD

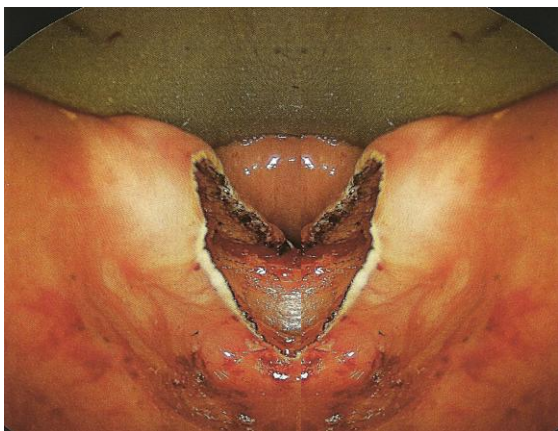


Figure 5: Party wall has been divided. Note that both the cricopharyngeus muscle and mucosa have been divided to the inferior aspect of the sac



Figure 6: ZD would be very difficult to treat with a stapler and is best done with CO₂ laser cricopharyngeal myotomy, as it is too shallow for the stapling technique

Surgical anatomy

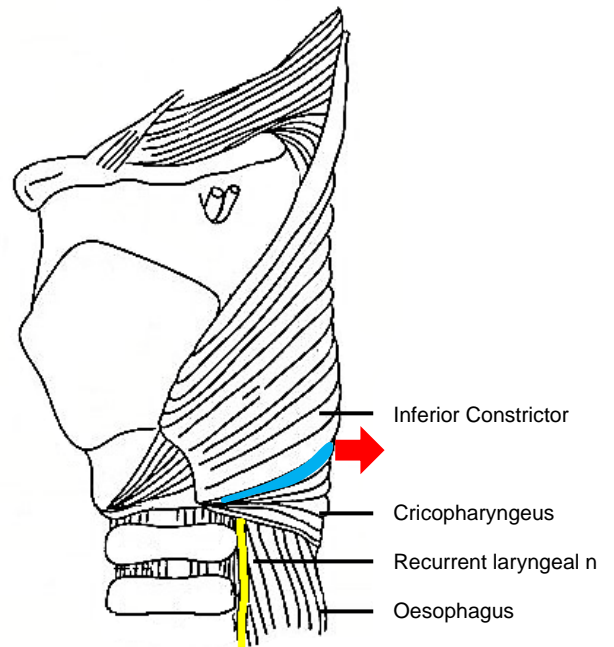


Figure 7: Red arrow shows where ZD extrudes through Killian's dehiscence (blue) between the inferior constrictor and the cricopharyngeus muscles

Figure 7 illustrates how the cricopharyngeus muscle fans out from its origin from

the cricoid cartilage to surround the proximal end of the oesophagus. Note Killian's dehiscence through which a ZD typically herniates between the cricopharyngeus and inferior constrictor muscles. Note also the proximity of the recurrent laryngeal nerve, which should be protected from injury with external surgical approaches.

Figure 8 illustrates the **buccopharyngeal fascial layer** that contains the pharynx and oesophagus, and a ZD.



Figure 8: Barium swallow of ZD. Note how the buccopharyngeal fascia contains the pharynx, oesophagus and diverticulum (green line)

The anatomic relationship between the ZD and the surrounding buccopharyngeal fascial layer is key to understanding how the upper digestive tract remains separated from the retropharyngeal space when incising the anterior wall of the diverticulum, or with isolated endoscopic cricopharyngeal myotomy. Disrupting this fascial layer can theoretically increase the likelihood of developing mediastinitis. When endoscopically dividing a hypertrophic cricopharyngeus muscle in the absence of a ZD, the bucco-

pharyngeal fascia is situated immediately behind the cricopharyngeus muscle; hence **great care must be taken to preserve this fascial layer when endoscopically dividing the cricopharyngeus muscle**. Despite initial fears that this fascia could not be preserved during endoscopic cricopharyngeal myotomy, *Chang et al* demonstrated in a cadaveric study that the buccopharyngeal fascial layer remained histologically intact with CO₂ laser cricopharyngeal myotomy.¹

Special investigations

Diagnosis of cricopharyngeal spasm and a ZD is confirmed with a contrast swallow or videofluoroscopy (Figures 1-2). Laryngoscopy is done to rule out other causes of dysphagia. Preoperative evaluation must include assessment of the function of the lower oesophageal sphincter, as cricopharyngeal myotomy in patients with an incompetent lower sphincter places them at risk of developing severe gastroesophageal and laryngopharyngeal reflux.

External cricopharyngeal myotomy

External cricopharyngeal myotomy is a quick and relatively simple procedure.

- Perform direct laryngoscopy and rigid oesophagoscopy to exclude other pathology causing dysphagia such as tumours and strictures
- Stent the oesophagus with a piece of suction tubing (Figure 9) / endotracheal tube / Maloney dilator; this helps the surgeon to palpate and identify the oesophagus during dissection
- Extend the neck and turn the head to the right side
- Palpate and identify the cricoid cartilage; this denotes the level of cricopharyngeus

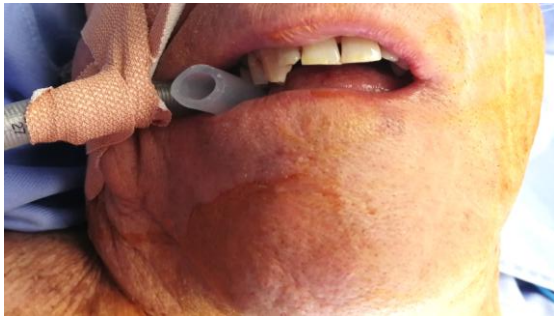


Figure 9: Suction tubing used to stent oesophagus

- Make a liberal transverse cervical skin incision to the left of the midline at the level of the cricoid (Figure 10). A transverse incision is cosmetically preferable to a vertical incision
- Incise platysma muscle
- Elevate subplatysmal flaps (Figure 11)



Figure 10: Transverse skin incision

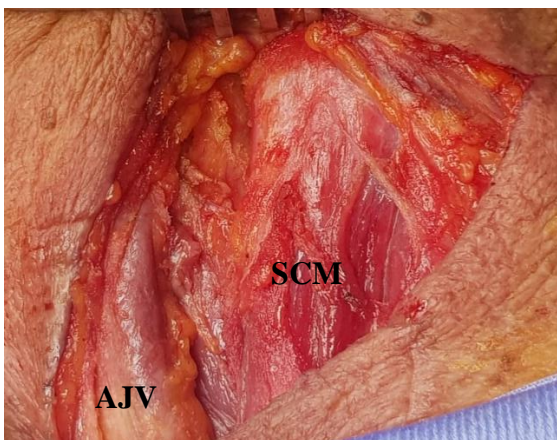


Figure 11: Liberal exposure achieved with transverse incision and subplatysmal flaps; AJV: Anterior jugular vein; SCM: Sternocleidomastoid

- Dissect along the anterior border of the sternocleidomastoid muscle
- Identify and divide the omohyoid muscle as it crosses the internal jugular vein
- Dissect along the medial aspect of the internal jugular vein and common carotid artery, and the lateral aspect of the thyroid gland, larynx and trachea
- Identify, ligate and divide the middle thyroid vein
- Continue the dissection until the prevertebral fascia is reached, and strip superiorly and inferiorly with a finger to expose the larynx, oesophagus, thyroid gland (medially) and contents of the carotid sheath (laterally) (Figure 12)

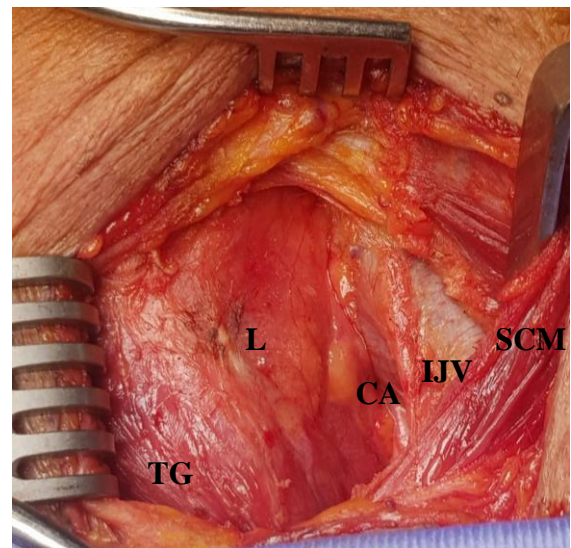


Figure 12: Retracting the sternocleidomastoid (SCM) exposes the thyroid gland (TG), larynx (L), internal jugular vein (IJV) and common carotid artery (CA)

- The superior laryngeal nerve defines the superior boundary of the dissection
- Palpate the cricothyroid joint
- Place a double pronged hook or sharp rake under the posterior edge of the thyroid cartilage or the thyroid gland and rotate the laryngotracheal complex to bring the oesophagus, cricopharyngeus and inferior pharyngeal constrictor muscles into view (Figure 13)

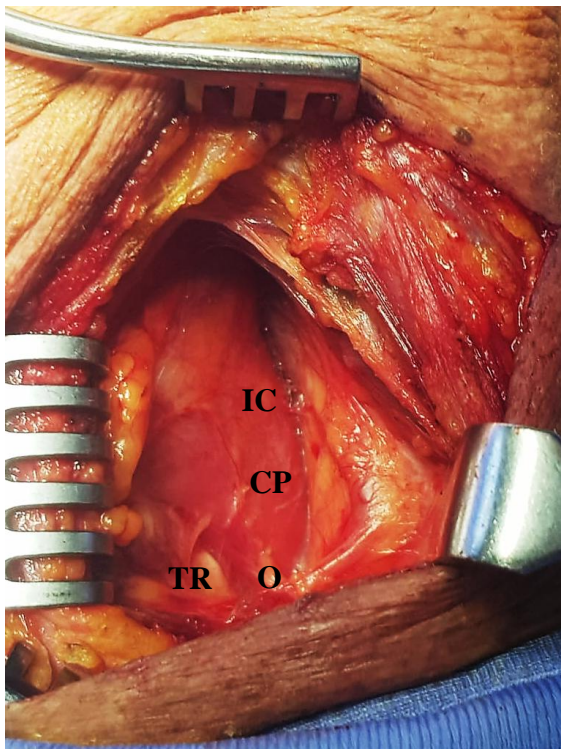


Figure 13: The rake is retracting the thyroid gland to expose the 1st tracheal ring (TR), Oesophagus (O), cricopharyngeus (CP), and inferior constrictor (IC)

- With this laryngotracheal rotation the RLN is safe, provided one dissects close to the posterior midline of the cricopharyngeus muscle
- Palpate and identify the cricoid cartilage
- Palpate and identify the firm tubing / dilator within the oesophagus
- The cricopharyngeus muscle is easily palpated and visualized, stretched over the oesophageal stent
- Cut vertically with a 15[#] scalpel blade through the cricopharyngeus muscle until the underlying oesophageal mucosa comes into view (Figures 14, 15)
- Ensure haemostasis
- Insert a suction drain, and close the neck in a layered fashion (Figure 16)
- Introduce oral fluids the same day if the mucosa has not been breached

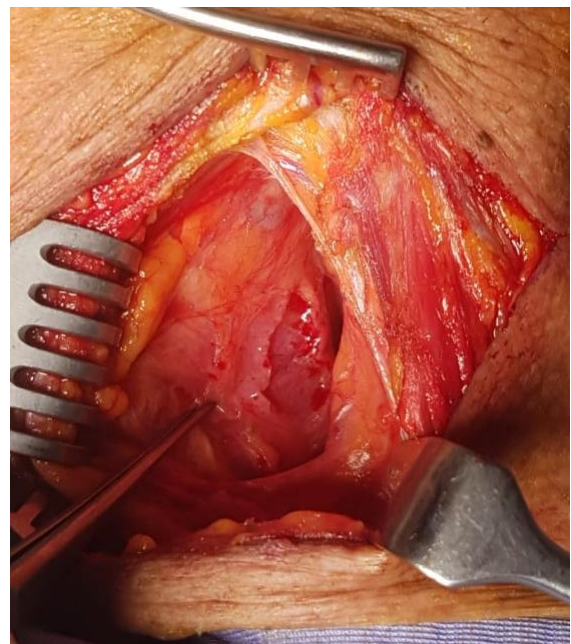


Figure 14: Cricopharyngeal myotomy, with oesophageal mucosa stretched over suction tubing coming into view

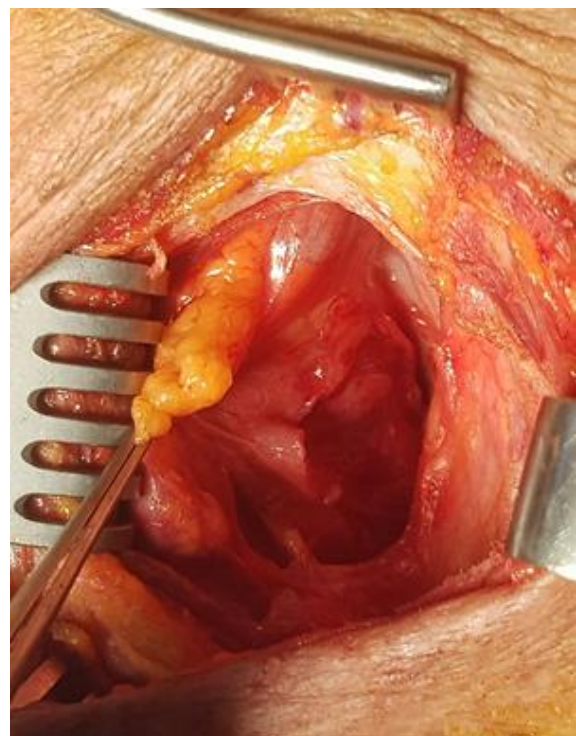


Figure 15: Completion of cricopharyngeal myotomy with muscle elevated from mucosa



Figure 16: Closed wound and suction drain

Endoscopic cricopharyngeal myotomy

- Administer broad spectrum antibiotics perioperatively
- General anaesthesia is done with orotracheal intubation (nasotracheal intubation hampers access)
- Protect the upper teeth with a gum guard
- Perform laryngoscopy
- Perform rigid oesophagoscopy
 - Inspect the oesophagus to rule out other pathology that may be causing symptoms such as tumours or strictures
 - Dilating the oesophageal opening with the scope facilitates subsequent passage of the diverticuloscope
- Insert a *Weerda* or *Benjamin diverticuloscope* (Figures 17, 10)
 - Extend the neck posteriorly as far as the cervical spine allows
 - Lubricate the scope
 - Advance the scope with blades slightly apart until the oesophageal opening appears
 - It is not always possible to insert the scope due to anatomical limitations
 - Pass the anterior blade of the scope into the oesophagus and keep the posterior blade against the posterior wall of the hypopharynx
 - Identify the transverse bar denoting the upper edge of cricopharyngeus

- Distract the blades further to better visualise the cricopharyngeus bar
- Suspend the scope with a scope holder

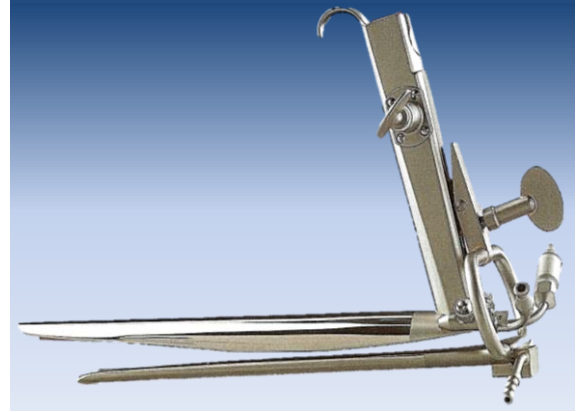


Figure 17: Weerda bivalve diverticuloscope



Figure 18: Benjamin diverticuloscope

- Visualise the cricopharyngeus bar using an operating microscope with an integrated CO₂ laser
- Set the CO₂ laser at 5-10W, CW mode and with a slightly defocused spot size to improve haemostasis
- Use CO₂ laser to transect the mucosa overlying the muscle in the midline (Figure 19)
- Meticulously completely transect the cricopharyngeus muscle without disrupting the posterior layer of periesophageal fascia (Figure 20)



Figure 19: Transmucosal laser cricopharyngeal myotomy: incising mucosa and muscle



Figure 20: Transmucosal laser cricopharyngeal myotomy: completed myotomy

- Instruct the anaesthetist to **avoid ventilating the patient with a face mask** when reversing the anaesthesia, as it may cause air to track through the defect into the tissues of the neck, causing surgical emphysema and potentially increasing the risk of a postoperative leak and sepsis
- Observe the patient overnight
- Following CO₂ laser, a small number of patients develop some subcutaneous emphysema; this almost never results in mediastinitis
- Monitor for signs and symptoms that signal mediastinitis *e.g.* radiating back or chest pain, fever, and tachycardia despite adequate pain control, as early intervention for this rare but potentially fatal complication is mandatory
- Commence a clear liquid diet the morning following surgery
- Discharge the patient if he/she tolerates a clear liquid diet without concerning signs or symptoms

- The patient should remain on liquids and soft foods for at least a week

Reference

1. Chang CWD, Liou SS, Netterville JL. Anatomic Study of Laser-Assisted Endoscopic Cricopharyngeus Myotomy. *Ann Otol Rhinol Laryngol* 2005; 114(12):897-901

Suggested chapters in Open Access Atlas

- **CO₂ laser transoral microsurgery (TLM)**
https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/CO2%20laser%20transoral%20microsurgery%20_TLM_.pdf
- **Surgery for pharyngeal pouch / Zenker's diverticulum**
https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/Surgery%20for%20pharyngeal%20pouch%20_Zenker_s%20diverticulum_.pdf

How to cite this chapter

Fagan JJ (2016). Cricopharyngeal myotomy surgical technique. In *The Open Access Atlas of Otolaryngology, Head & Neck Operative Surgery*. Retrieved from <https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/Cricopharyngeal%20myotomy%20surgical%20technique.pdf>

Author & Editor

Johan Fagan MBChB, FCS (ORL), MMed Emeritus Professor and Past Chair
 Division of Otolaryngology
 University of Cape Town
 Cape Town, South Africa
johannes.fagan@uct.ac.za

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