

# Intraoperative Dye Test in Total Laryngectomy: A Technique to Reduce the Incidence of Pharyngocutaneous Fistula

Adekunle Daniel, Segun Ayodeji Ogunkeyede, Ayotunde James Fasunla, Onyekwere George Benjamin Nwaorgu

Department of  
Otorhinolaryngology, College  
of Medicine, University  
of Ibadan, Ibadan and  
University College Hospital,  
Ibadan, Nigeria

Submitted: 22-Dec-2019  
Revised : 06-May-2020  
Accepted : 26-May-2020  
Published : 27-Jul-2020

## INTRODUCTION

Pharyngocutaneous fistula (PCF) is one of the significant complications of total laryngectomy and usually occurs in the immediate postoperative period (<30 days after surgery).<sup>[1]</sup> Whenever it occurs at a later period, it is usually due to the progression of the oncologic disease. The reported incidence is variable depending on the setting and disease stage ranging from 3% to 65%.<sup>[2]</sup> Poor surgical technique and incomplete seal during the reconstruction of the neopharynx have been implicated in its aetiology. Other risk factors include preoperative neck irradiation, poorly controlled diabetes, hypothyroidism, and anemia.<sup>[3,4]</sup>

PCF causes increased length of hospital stay, delayed initiation of oral diet, complex wound care, and

occasionally necessitating additional surgery for closure.<sup>[3,5-8]</sup> It also delays the commencement of adjuvant therapy. The financial burden associated with this complication can be quite enormous, especially in low socioeconomic countries where health insurance is rudimentary, and the patients can ill afford the high cost of health care. It is, therefore, of paramount importance to reduce the incidence of PCF to its barest minimum. The detection and immediate repair

**Address for correspondence:** Dr. Segun Ayodeji Ogunkeyede,  
Department of Otorhinolaryngology, University of Ibadan,  
Ibadan and University College Hospital, Ibadan, Nigeria.  
E-mail: segunkeyede@yahoo.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** WKHLRPMedknow\_reprints@wolterskluwer.com

**How to cite this article:** Daniel A, Ogunkeyede SA, Fasunla AJ, Nwaorgu OGB. Intraoperative dye test in total laryngectomy: A technique to reduce the incidence of pharyngocutaneous fistula. Niger J Surg 2020;26:127-9.

## ABSTRACT

**Background:** Pharyngocutaneous fistula (PCF) could complicate laryngectomy in advanced disease. The cause is multifactorial, and this may include poor technique in pharyngeal repair. Intraoperative assessment of the repaired mucosa integrity for adequate closure may reduce PCF, but this is not routinely done. **Objective:** The objective of this study is to describe a novel technique that has been successfully used to ascertain intraoperative pharyngeal repair integrity. **Methods:** Thirty-one patients who had total laryngectomy and pharyngeal reconstruction for locally advanced laryngeal squamous cell carcinoma were studied. Connell extramucosal suturing technique was used for the mucosal repair. Thereafter, a small feeding tube was introduced through the oral cavity to the site of the pharyngeal repair, and diluted methylene-blue dye was injected through it while digitally occluding the cervical esophagus. Whenever leakage of the dye was seen, the leakage site (s) was repaired. Thereafter, the dye test would be repeated to confirm the integrity of the repair. **Results:** Their mean age was  $53.4 \pm 10.9$  years. Seven (22.6%) patients had Stage 3 disease and 24 (77.4%) had Stage 4 disease. All the patients had neck dissection, whereas 3 (9.7%) patients had salvage laryngectomy postradiotherapy. Dye test was performed intraoperatively for all the patients and leakages were seen in 4 (12.9%) patients which were successfully repaired. Oral feeding was commenced on the fifth postoperative day, and none of the patients had PCF. **Conclusion:** Performing a dye test intraoperatively helps detect the point of leakage and immediate repair will prevent PCF.

**KEYWORDS:** Dye test, feeding tube, laryngeal tumor, laryngectomy, pharyngocutaneous fistula, radiotherapy

## Access this article online

### Quick Response Code:



**Website:** www.nigerianjsurg.com

**DOI:** 10.4103/njs.NJS\_69\_19

of leakage from the reconstructed pharynx intraoperatively may reduce the incidence of PCF.

In this study, evaluation of the integrity of the reconstructed pharynx was done with a dye test intraoperatively and where there was leakage, immediate repair was done to forestall PCF. The reduced incidence of PCF observed from this procedure in our center has prompted this report.

## METHODS

This was a prospective study of patients who had total laryngectomy with neck dissection for advanced squamous cell carcinoma of the larynx from January 2014 to December 2018 in the Department of Otorhinolaryngology, University College Hospital, Ibadan. The institution's ethical approval was obtained, thereafter, the patients were consecutively recruited for the study, and the participants gave informed consent. The same surgeon did all the surgical procedures. Patients with N0 neck had total laryngectomy with elective neck dissection, while those with neck nodes had modified neck dissection. Nasogastric tube for postoperative feeding was passed for all the patients. The neopharynx was constructed in three layers. After the completion of the first layer, using Connell extramucosal suturing technique, a small (12–14 Fr) feeding tube was passed through the oral cavity and hence into the repaired pharynx. This was confirmed by the presence of a bulge in the anterior wall of the neopharynx. The feeding tube was positioned at the site of the repair and diluted methylene blue of about 60–100 ml was injected through the feeding tube under controlled pressure with a 50 cc syringe. Antegrade progression of the dye into the distal esophagus was prevented by digital compression of the cervical esophagus. This caused distension of the repaired area and any leakage through the sutured pharynx was readily observed. To further confirm the presence or absence of a leak, clean gauze was placed over the area of the reconstruction and the procedure repeated. Leakage was defined as escape of the dye into the wound or staining of the gauze. When present, the site was repaired in simple interrupted fashion and sometimes reinforced with the submucosal layer. A repeat of the test was done to confirm the absence of leak at the site. Other layers were reconstructed to complete the repair. The patients were fed at the early postoperative period through the nasogastric tube as tolerated. On the 5<sup>th</sup> postoperative day, a cup of diluted methylene blue was given to every patient to drink, and their neck incision observed for a leakage of the dye. A leakage in the neck was considered positive dye test (presence of PCF) and when there was no leakage, it was considered negative dye test (absence of PCF).

In the absence of PCF, nasogastric tube was removed and graded oral diet was commenced. Postoperatively, the stoma and neck wound sutures were removed on the 7<sup>th</sup> postoperative day.

## RESULTS

A total of 31 patients had total laryngectomy for advanced laryngeal squamous cell carcinoma. There were 26 males and 5 females (5.2:1). The age range was 38–80 years, with a mean age of  $53.4 \pm 10.9$  years. Seven (22.6%) patients had T3-tumors, whereas 24 (77.4%) had T4-tumors. There was no evidence of distant metastasis in any of the patients. Twenty-eight (90.3%) patients had tracheostomy to relieve upper airway obstruction before total laryngectomy. Twenty-one (67.7%) patients had modified neck dissection. Three (9.7%) patients had laryngectomy for recurrent disease after radiotherapy. Two (6.5%) of the patients who had salvage laryngectomy had partial pharyngectomy with augmentation of the pharynx with pectoralis major myocutaneous pedicle flap.

All the patients had intraoperative dye test, of which 4 (12.9%) patients had leakage of the dye from the reconstructed pharynx and were repaired. No patient had PCF in the immediate postoperative period.

## DISCUSSION

PCF still complicates some cases of total laryngectomy even in the best hands. The cause is multifactorial and includes poor surgical technique, previous radiotherapy to neck, poor glycemic control, intraoperative blood transfusion, malnutrition, and anemia.<sup>[9]</sup> Pharyngeal reconstruction is an integral part of total laryngectomy and the techniques employed for the surgical repair of the pharyngeal mucosa include Connell, Gambee, Lembert, continuous interlocking sutures, and stapling.<sup>[10]</sup>

We studied 31 patients who had total laryngectomy and pharyngeal reconstruction using Connell continuous extramucosal closure technique. It was observed that two of the pharyngeal repairs were not watertight despite a satisfactory pharyngeal apposition. This would not have been noticed without the intraoperative dye test. The incidence of PCFs following total laryngectomy is 3%–65% in previous studies.<sup>[2]</sup> The defective mucosa apposition observed might have contributed to earlier cases of PCF reported in this environment.<sup>[11]</sup> In this present study, no patient developed early PCF (within 30 days), unlike 5.2%–11.9%, the prevalence of PCF in the early reports from our department.<sup>[11,12]</sup>

To the best of our knowledge, there is no study which has investigated the integrity of pharyngeal repair during

total laryngectomy. Integrity of anastomosis of the bowel has been tested either with air<sup>[13]</sup> or clear fluid.<sup>[14]</sup> When air is used, it is insufflated into the anastomotic segment placed under a water seal. Evidence of leakage is the presence of bubbles of air in the water. The disadvantage is that the exact leaking point is difficult to identify.

When clear fluid is used for the test, the leakage sight may not be easily identified because it is colorless. The use of dye in the test of alimentary tract anastomotic integrity will allow the easy identification of the leakage if present.

Various techniques have been employed to detect/confirm and determine the size of PCF postoperatively. These include dye tests, videofluoroscopy, oral pharyngo-esophageal scintigraphy, and laser-assisted indocyanine dye.<sup>[15,16]</sup>

This dye test may also be employed for all the techniques of pharyngeal repair. However, this method is limited by inability to measure the injection pressure of the test dye. Perhaps, this can be overcome by the use of a specially adapted manometer. Subjective digital pressure on the syringe plunger that is safe is recommended for injecting the dye.

## CONCLUSION

This simple intraoperative dye test, in our opinion, can be a technique of value to the surgeon in ensuring a water tight pharyngeal repair and consequently reduce the incidence of PCF.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Cavalot AL, Gervasio CF, Nazionale G, Albera R, Bussi M, Staffieri A, *et al.* Pharyngocutaneous fistula as a complication of total laryngectomy: Review of the literature and analysis of case records. *Otolaryngol Head Neck Surg* 2000;123:587-92.
- Bresson K, Rasmussen H, Rasmussen PA. Pharyngo-cutaneous fistulae in totally laryngectomized patients. *J Laryngol Otol* 1974;88:835-42.
- Saki N, Nikakhlagh S, Kazemi M. Pharyngocutaneous fistula after laryngectomy: Incidence, predisposing factors, and outcome. *Arch Iran Med* 2008;11:314-7.
- Redaelli de Zinis LO, Ferrari L, Tomenzoli D, Premoli G, Parrinello G, Nicolai P. Postlaryngectomy pharyngocutaneous fistula: Incidence, predisposing factors, and therapy. *Head Neck* 1999;21:131-8.
- Boscolo-Rizzo P, De Cillis G, Marchiori C, Carpenè S, Da Mosto MC. Multivariate analysis of risk factors for pharyngocutaneous fistula after total laryngectomy. *Eur Arch Otorhinolaryngol* 2008;265:929-36.
- Tsou YA, Hua CH, Lin MH, Tseng HC, Tsai MH, Shaha A. Comparison of pharyngocutaneous fistula between patients followed by primary laryngopharyngectomy and salvage laryngopharyngectomy for advanced hypopharyngeal cancer. *Head Neck* 2010;32:1494-500.
- Withrow KP, Rosenthal EL, Gourin CG, Peters GE, Magnuson JS, Terris DJ, *et al.* Free tissue transfer to manage salvage laryngectomy defects after organ preservation failure. *Laryngoscope* 2007;117:781-4.
- Patel UA, Moore BA, Wax M, Rosenthal E, Sweeny L, Militikh ON, *et al.* Impact of pharyngeal closure technique on fistula after salvage laryngectomy. *JAMA Otolaryngol Head Neck Surg* 2013;139:1156-62.
- Dedivitis RA, Ribeiro KC, Castro MA, Nascimento PC. Pharyngocutaneous fistula following total laryngectomy. *Acta Otorhinolaryngol Ital* 2007;27:2-5.
- Mehmet H, Davut A, Sundus A, Fevzi S, Suay O. Modified continuous mucosal connell suture for the pharyngeal closure after total laryngectomy: Zipper suture. *Clin Exp Otorhinolaryngol* 2015;8:281-8.
- Fasunla AJ, Ogundoyin OA, Onakoya PA, Nwaorgu OG. Malignant tumors of the larynx: Clinicopathologic profile and implication for late disease presentation. *Niger Med J* 2016;57:280-5.
- Ogunkeyede SA, Adeyemo AA, Daniel A, Yaro PJ, Ogundoyin OA. Pharyngo-cutaneous fistula post total-laryngectomy: A local experience. *Niger J Med* 2020;29:69-72.
- Ricciardi R, Roberts PL, Marcello PW, Hall JF, Read TE, Schoetz DJ. Anastomotic leak testing after colorectal resection: What are the data? *Arch Surg* 2009;144:407-11.
- Wheeler JM, Gilbert JM. Controlled intraoperative water testing of left-sided colorectal anastomoses: Are ileostomies avoidable? *Ann R Coll Surg Engl* 1999;81:105-8.
- Galli J, Valenza V, Parrilla C, Galla S, Marchese MR, Castaldi P, *et al.* Pharyngocutaneous fistula onset after total laryngectomy: Scintigraphic analysis. *Acta Otorhinolaryngol Ital* 2009;29:242-4.
- Partington EJ, Moore LS, Kahmke R, Warram JM, Carroll W, Rosenthal EL, *et al.* Laser-assisted indocyanine green dye angiography for postoperative fistulas after salvage laryngectomy. *JAMA Otolaryngol Head Neck Surg* 2017;143:775-81.