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Utility of the Transnasal Esophagoscope in the Management of Chemoradiation-Induced Esophageal Stenosis

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Abstract

Objective: This study aimed to describe management of esophageal stenosis after chemoradiation therapy for head and neck squamous cell carcinoma (HNSCC), with particular emphasis on techniques and outcomes with the use of the transnasal esophagoscope (TNE) in the office as well as operating room settings.

Methods: Retrospective analysis of all patients with esophageal stenosis following head and neck cancer radiation, with or without chemotherapy, and managed with TNE-assisted esophageal dilation over a 5-year period. Preoperative and postoperative swallowing function were assessed objectively with the Functional Outcome Swallowing Scale (FOSS; ranging from score 0, a normal diet, to score 5, complete dependence on nonoral nutrition).

Results: Twenty-five patients met inclusion criteria. The mean pretreatment FOSS score was 4.4, whereas the mean posttreatment FOSS score was 2.7 (Wilcoxon signed-rank test, $P < .001$). Prior to dilation, 16 patients were completely gastrostomy-tube dependent (FOSS 5), of whom 12 (75%) were able to tolerate oral nutrition for a majority of their diet following treatment according to our protocol. No complications were noted.

Conclusion: Dysphagia following chemoradiation therapy for HNSCC is often related to esophageal stenosis. With the aid of TNE, we have developed a successful treatment strategy for esophageal stenosis with improved success rates.

Keywords

chemoradiation, esophageal dilation, esophageal stenosis, head and neck squamous cell carcinoma, transnasal esophagoscopy

Introduction

Squamous cell carcinomas of the head and neck occur frequently, with more than 500000 cases diagnosed worldwide annually.[1] Radiation with concurrent chemotherapy (CRT) is an increasingly used treatment modality for these cancers. As survival rates improve with advances in care, organ preservation—that is, the maintenance of normal mechanisms of breathing, deglutition, and communication—becomes of paramount importance. Following successful treatment of head and neck squamous cell cancer (HNSCC), dysphagia is the most common symptom decreasing quality of life, affecting 50% to 64% of patients after CRT.[2,3]

Whereas early dysphagia is usually temporary, late dysphagia often results from chronic inflammation and fibrosis and is much more difficult to manage.[4-7] This fibrosis may progress to hypopharyngeal or esophageal strictures, which occur in approximately 21% of patients undergoing CRT.[8,9] Risk factors implicated in stricture formation in the general population include reflux, older age, and caustic ingestion; among head and neck cancer patients with HNSCC, additional factors include hypopharyngeal primary site, combined chemoradiation (vs radiation alone), radiation dose, prior neck dissection, female sex, and treatment-induced mucositis.[10]

Objective assessment of dysphagia is essential and comprises 2 complementary tests: the videofluoroscopic swallow study, also known as a modified barium swallow study (MBSS), and the functional endoscopic evaluation of swallow (FEES).[11] Whereas the advantages of FEES include rapidity of the test in an office setting, direct observation of native secretions and swallow anatomy, and lack of radiation for the procedure, MBSS is superior in evaluating the oral and upper esophageal phases.[12] In addition to these tests, flexible transnasal esophagoscopy has seen increasing use in the otolaryngology dysphagia clinic, particularly in

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Table 1. Functional Outcome Swallowing Scale.[a]

Stage	Description
0	Normal function; asymptomatic
1	Normal function; episodic or daily symptoms of dysphagia
2	Compensated abnormal function manifested by significant dietary modifications or prolonged mealtime, without weight loss or aspiration
3	Decompensated abnormal function, with weight loss of 10% or less of body weight over 6 months due to dysphagia, or daily cough, gagging, or aspiration during meals
4	Severely decompensated abnormal function, with weight loss of more than 10% of body weight over 6 months due to dysphagia, or severe aspiration with bronchopulmonary complications; nonoral feeding recommended for most of nutrition
5	Nonoral feeding for all nutrition

[a]Adapted from Salassa.[15]

evaluating the presence, severity, and length of esophageal stenoses.[13]

Following assessment of the stenosis, esophageal dilations with Savary-Gilliard dilators or controlled radial expansion (CRE) balloons can be performed in both operating room and office-based settings with modifications of prior techniques.[14] In this study, we review our management of esophageal stenosis after CRT for HNSCC. We place special emphasis on the use of the transnasal esophagoscope (TNE) to demonstrate that this method has a high success rate with minimal potential for complications. The Functional Outcome Swallowing Scale (FOSS), described by Salassa[15] in 1999, was used to quantify dysphagia prior to and following treatment (Table 1).

Methods

Institutional review board approval was obtained for this study. Inclusion criteria were as follows: history of HNSCC treated with radiation and/or chemotherapy, presence of esophageal stenosis, management of esophageal stenosis by esophagoscopy and dilation, and documentation of swallowing function with instrumental swallow tests (MBSS and/or FEES) both prior to and following dysphagia treatment. Patients with multilevel esophageal stenosis were excluded. Patients who underwent surgery, including tracheostomy, neck dissection, or resection of the primary tumor, were also excluded, with the following exceptions: gastrostomy tube (G-tube) placement, tonsillectomy, or panendoscopy with biopsies.

We managed esophageal stenosis with the following algorithm. After a history and physical examination were performed, FEES was performed in office to assess the current safe diet, and transnasal esophagoscopy was performed if esophageal stenosis was suspected based on MBSS, dysphagia to solid foods, or severe piriform sinus residue. Following a definitive office diagnosis of esophageal stenosis, patients were scheduled for surgery.

In the operating room, suspension direct laryngoscopy was performed under general anesthesia and the rigid operating laryngoscope was placed in the postcricoid space. The TNE was then passed through the laryngoscope into the hypopharynx and advanced into the esophagus. Several dilation scenarios were possible at this point. (1) In a majority of cases, the stricture was seen, and the TNE could be passed atraumatically beyond the stenosis and into the distal esophagus. A CRE balloon was then passed through the stricture under direct visualization and dilation was performed to 18 mm. Alternatively, a Savary-Gilliard dilator guidewire could be passed through the working port of the scope, and dilation could then be performed over the guidewire after retracting the scope completely. (2) The stricture was seen, but the TNE would not pass through the stricture. This indicated that the stenosis diameter was smaller than the diameter of our scope (5.1 mm). At this point, gentle passage of a Savary-Gilliard dilator guidewire was attempted while directly visualizing its passage through the stenotic opening. If this was possible without resistance, dilation was then performed using Savary-Gilliard dilators up to 9 to 10 mm just past the stenosis. Then, the TNE was passed through the stenosis to ensure normal esophageal lumen, after which CRE balloon dilation was performed, typically to 15 mm. (3) A complete stricture was encountered, and the TNE could not pass. In this case, the G-tube was removed and retrograde esophagoscopy was performed. The TNE could be inserted through the G-tube site without dilation of the G-tube tract (Figure 1) and was advanced through the lower esophageal sphincter to the upper esophagus to the stricture site. Anterograde palpation of the esophageal stricture using a blunt instrument such as a rigid esophageal suction tube assisted in identifying the stricture, and under direct retrograde visualization with the TNE, the stricture was punctured. A Savary-Gilliard guidewire was passed through the stenosis with both retrograde and anterograde visualization. This guidewire could be inserted in an anterograde manner under direct visualization of the TNE and dilation performed as in situation 2 above. Topical mitomycin-C (MMC), which inhibits fibroblast proliferation, was applied to the affected region in all cases, using cotton pledgets at a concentration of 0.4 mg/mL for 4 minutes, a technique that has been successfully applied in the treatment of upper aerodigestive tract stenosis.[16-19]

A second dilation was scheduled for 1 to 2 weeks after the first dilation. The second dilation allows an assessment of efficacy of the first dilation, which helps to counsel patients on the anticipated treatment course in regard to repeat dilations and provides an opportunity for the second

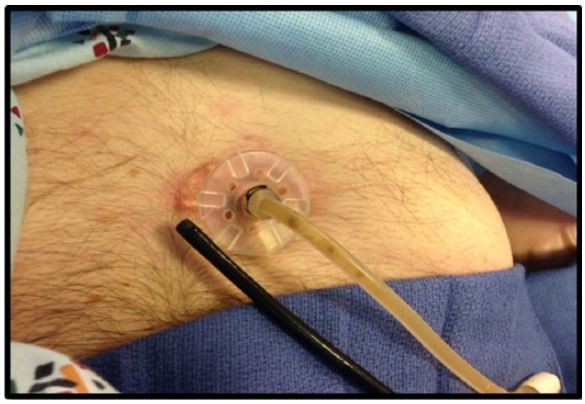

Figure 1. The transnasal esophagoscope (TNE) used in this study pictured adjacent to a standard gastrostomy tube (G-tube), showing similarity of diameters. With the G-tube removed, the TNE can be passed for retrograde esophagoscopy without further dilation of the G-tube site.

application of MMC.[19] Dilation was typically performed to 18 to 20 mm diameter using the CRE balloon. All patients were referred for swallow therapy after the second dilation. Some patients were scheduled for office dilation depending on the degree of stenosis and residual dysphagia. Office dilation was undertaken preferentially as many patients had significant trismus and were high anesthetic risks regarding intubation. Office esophageal dilations were accomplished as follows: bilateral nasal cavities were anesthetized and decongested with topical lidocaine and oxymetazoline. Thereafter, transnasal esophagoscopy was performed via the more patent nasal cavity; once the stenosis was identified, a CRE balloon dilator was passed via the contralateral nasal cavity and to the level of stenosis under direct visualization. Passage of the balloon was sometimes aided by bending the tip slightly to traverse the nasopharyngeal curvature. Dilation was then performed using the CRE balloon, typically to 18 mm. Patients received proton-pump inhibitors for the first 3 months after initial dilation, with further prescriptions based on the presence of reflux symptoms. Esophagoscopy and dilations were performed until the patient's symptoms were alleviated satisfactorily.

To analyze outcomes of our esophageal stenosis treatment algorithm, pretreatment and posttreatment FOSS scores were compared with a Wilcoxon signed-rank test. The number of dilations undergone by each patient was noted, as was the elapsed time between dilations.

Results

Among the 115 patients identified, 81 were excluded due to use of surgery (eg, neck dissection, tumor resection) during their initial treatments and 9 were excluded due to requiring additional surgical procedures at the time of esophageal dilation. There were 25 patients, 21 male and 4 female, who met inclusion criteria (Table 2). The median age was 63 years (range, 40-84 years). The most common primary site was oropharynx (n = 13, 52%), followed by an unknown primary (n = 5, 20%). All patients received combined chemoradiation therapy. Median time from completion of CRT to initiation of esophageal stenosis management was 6.0 months (range, 2 months to 30 years). All patients in the study had single-level stenosis.

Table 2. Patient Characteristics.

Age, y	
Median	63
Range	40-84
Sex	
Male	21
Female	4
Primary site	
Oropharynx	13 (52%)
Unknown primary	5 (20%)
Hypopharynx	3 (12%)
Nasopharynx	2 (8%)
Larynx	1 (4%)
Oral cavity	1 (4%)
Elapsed time between termination of CRT and initiation of esophageal stenosis treatment	
Median	6.0 months
Range	2 months to 30 years
Elapsed time between esophageal dilations	
Median	21 days
Range	6 days to 1.8 years
Number of dilations performed	
Median	2
Range	1-16
Functional Outcome Swallowing Scale score	
Prior to treatment of esophageal stenosis	
Mean	4.36
Range	2-5
Following treatment of esophageal stenosis	
Mean	2.40
Range	1-5

The median number of dilations performed on each patient was 2 (range, 1-16). For patients undergoing multiple dilations, the median time between procedures was 21 days (range, 6 days to 21 months). In 3 patients (12%) who were completely G-tube dependent, retrograde esophagoscopy was performed via the G-tube with the TNE to delineate the esophageal lumen. Mean pretreatment FOSS score for all patients was 4.4 (median, 5; range, 2-5); mean posttreatment FOSS score was 2.7 (median, 3; range, 1-5). A Wilcoxon signed-rank test confirmed a

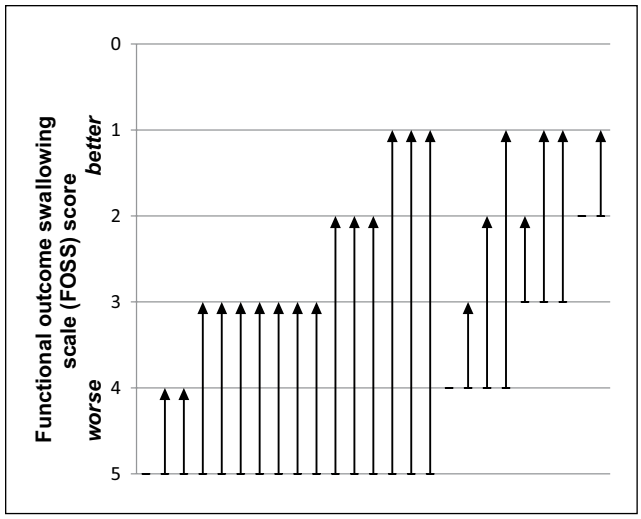

Figure 2. Improvement in Functional Outcome Swallowing Scale (FOSS) score was seen in all but 3 of 25 patients following our esophageal dilation protocol; no patients worsened after therapy. Arrows depict change in FOSS scores following therapy.

statistically significant difference between FOSS scores prior to and following esophageal stenosis treatment ($P < .001$). The FOSS score did not worsen in any patients (Figure 2).

Prior to treatment, 16 patients (64%) were completely dependent on nonoral nutrition, primarily via G-tube (FOSS score of 5); following treatment, only 2 patients (8%) were completely dependent on nonoral nutrition. Of the 16 patients completely dependent on nonoral nutrition prior to treatment, 12 (75%) transitioned to oral intake for a majority of their nutrition following therapy (FOSS score of 3 or better). Out of all patients studied, 6 (24%) were ultimately on a normal diet following therapy (FOSS score of 0 or 1).

Only 3 patients required 10 or more dilations. Two of these had required initial combined anterograde-retrograde dilations via the gastrostomy, whereas the third received numerous maintenance office dilations. They were typically treated about 3 months apart as they subjectively felt improvements with each office dilation.

Patients who were treated within 6 months after completion of CRT (early dilation) had improved results relative to those treated beyond 6 months (late dilation). Among the 13 patients with early dilation, the mean pretreatment and posttreatment FOSS scores were 4.5 and 2.2, respectively, whereas the 12 patients with late treatment had mean pretreatment and posttreatment FOSS scores of 4.2 and 2.7, respectively. Only 1 of 13 early patients had a posttreatment FOSS score of 4 or 5, as compared to 3 of 12 patients in the late group. There were no documented complications, including zero occurrences of esophageal perforation or mediastinitis.

Discussion

Dysphagia resulting from esophageal stenosis following successful chemoradiation therapy for HNSCC has a significant effect on quality of life.[20] In this setting, optimal treatment is accomplished with the use of serial dilation.[6,21,22] At our institution, we have developed an algorithm to manage esophageal stenosis in the setting of prior CRT, where initial evaluation includes the complementary studies of MBSS, FEES, and transnasal esophagoscopy.

The first dilation occurs in a controlled, operative setting under general anesthesia. The flexible scope is preferred because many of these patients have trismus, friable pharyngeal mucosa, and/or lack of extension precluding rigid esophagoscopy. The otolaryngologist is also more familiar with use of this scope, which has improved maneuverability compared to the regular or even the "ultrathin" but long scope that is typically used in gastroenterology. Following visualization of the stenosis, dilation is performed with CRE balloon or Savary-Gilliard dilators. When using the latter, a guidewire is first passed atraumatically through the stenosis—either parallel to the scope or through the working port of the scope—before the dilator is introduced, thus minimizing the risk of mucosal trauma or extraluminal passage. Retrograde esophagoscopy via the gastrostomy site remains a safe option for patients with complete stenosis. Mitomycin-C can also be applied at this time. The complication risk is very low, and all patients could be discharged to home after recovery from anesthesia. Depending on the severity of stenosis, the timing and the setting of future dilations (office vs operative) are determined.

In our series of patients, we have demonstrated excellent outcomes with our structured management of esophageal stenosis. On Wilcoxon signed-rank test, there was a statistically significant improvement (ie, decrease) in FOSS score, with 6 patients (24%) ultimately tolerating a normal diet (FOSS score of 1). Sixteen patients (64%) were initially G-tube dependent (FOSS score of 5); 12 of these patients (75%) tolerated the oral route for the majority of nutrition (FOSS score of 3 or better) following our therapy.

This compares favorably to previous series: Silvain et al[6] described an early series of 11 patients with esophageal stricture, 9 of whom underwent dilation. This series noted complications in 4 patients, including 1 death, and 4 patients were described to have a semisolid diet after treatment. Dhir et al[23] performed dilations on 21 patients who had undergone radiation with or without surgery and achieved dysphagia relief in 15 of 20 (75%) patients for a median of 14 weeks; however, long-term follow-up was not available. Laurell et al[7] described a similar group who developed moderate to severe esophageal stenosis; their management included both endoscopic dilation and microvascular free flap esophageal reconstruction. In this study, a "nearly normal" diet was achieved in 17 of 22 (78%) patients, although

there was no report of preintervention or postintervention G-tube status. Ahlawat et al[24] performed dilation on 24 patients and reported technical success (endoscopic dilation to 14 mm) in 19 patients and functional success (occasional dysphagia to solid foods) in 18 patients. Again, G-tube status was not available. Our technique improves on these outcomes, however, as the rate of conversion from G-tube dependence to predominantly oral nutrition—75% in our study population—greatly exceeds the success rates reported previously.[6,7,23,24] Furthermore, whereas others have demonstrated good results (81% of patients maintaining weight with oral diet) from dilation of the hypopharynx and upper esophagus,[25] we have achieved these results without complications and with serial dilations in the clinic setting without general anesthesia.

Our use of the TNE accomplishes both diagnostic and therapeutic purposes. Transnasal esophagoscopy is well tolerated in awake patients in the office setting, and we employ the same scope in the operating room, which is beneficial for consistency in assessing the degree of stenosis. Exposure for rigid esophagoscopy may be quite difficult or impossible following CRT, and thus use of the flexible TNE improves our ability to treat challenging cases. Some of the residual esophageal lumens are quite small, and using the 5.1-mm TNE allows successful passage through the stenosis that is not always achieved with the larger gastroscopes. Similarly, the small size allows retrograde passage through the gastrostomy without requiring dilation, thus minimizing morbidity; our results compare very favorably to another series of 45 patients using the retrograde approach reporting G-tube site morbidities in 7 of 63 (11%) procedures.[26] The ability to perform transnasal esophagoscopy and dilation in the office setting confers additional advantages, not in the least that general anesthesia and its concomitant risks are avoided.

Conclusion

Patients with esophageal stenosis after CRT can be successfully managed, with the majority achieving a full oral diet. Transnasal esophagoscopy is an important tool in our armamentarium of management of esophageal stenosis following chemoradiation for head and neck cancer. The versatility of transnasal esophagoscopy as an adjunct to esophageal dilation, with either guidewire or balloon dilators, allows for its use in both operative and office settings. As demonstrated here, our algorithm is well tolerated, highly effective, and associated with little morbidity.

Declaration of Conflicting Interests

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