

Pretreatment Swallowing Assessment in Head and Neck Cancer Patients

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Objectives/Hypothesis: To discuss patient variables associated with swallowing dysfunction in head and neck cancer (HNCA) patients prior to intervention.

Study Design: Prospective, multi-institutional cohort study.

Methods: All patients included had newly diagnosed head and neck malignancies. Patients undergoing instrumental swallowing evaluations prior to oncologic management were included for analysis. Pretreatment Penetration Aspiration Scores (PAS) were analyzed by primary tumor site, tumor stage, and standard demographic variables.

Results: The final study sample was comprised of 204 consecutive individuals with newly diagnosed HNCA. Patients with advanced primary tumor (T) stage laryngeal/hypopharyngeal tumors had higher mean PAS scores (5.18) in contrast to early stage larynx/hypopharynx (1.93), advanced stage oral cavity/oropharynx (2.24), and early stage oral cavity/oropharynx (1.54, $P < .0001$), indicative of poorer function. Age, race, and sex were not associated with PAS scores. Multivariate logistic regression revealed significantly poorer PAS scores in patients with advanced primary tumors (odds ratio [OR] = 3.83, 95% confidence interval [CI], 1.84-8.00, $P < .0001$) and laryngeal/hypopharyngeal primary site disease (OR = 3.04, 95% CI, 1.41-6.54, $P = .004$), after controlling for all other variables.

Conclusions: This series demonstrates that swallowing dysfunction in high-risk patients may be present in the pretreatment state and should be considered when determining candidacy for organ preservation modalities. These data highlight the importance of instrumental swallowing evaluations prior to intervention, particularly for those individuals with advanced stage and/or laryngeal/hypopharyngeal tumors.

Key Words: Dysphagia, head and neck cancer, Fiberoptic Endoscopic Evaluation of Swallowing.

Level of Evidence: 2b

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INTRODUCTION

Patients with head and neck cancer (HNCA) commonly experience difficulty with eating and swallowing, regardless of treatment modality. The treatment of HNCA often negatively impacts quality of life and leads to nutritional deficiency due to impaired swallowing function.¹ Oropharyngeal deficits including reduced epiglottic tilt, pharyngeal constrictor function, laryngeal elevation, tongue base retraction, airway protection, pharyngeal clearance, and cricopharyngeal opening have been cited in the literature as common findings after organ preservation therapies for HNCA.²⁻⁴

Recent studies have shown pretreatment deficits to be common in HNCA patients, particularly those with

advanced stage disease.^{5,6} Further, these series have shown poor correlation between measurable deficits and patients perceptions of these deficits. Due to the elevated risk of silent dysfunction in HNCA, instrumental assessment is essential prior to oncologic therapy, particularly for those individuals at greatest risk for dysfunction.⁷ Determining aspiration risk prior to treatment may assist in ensuring optimal intervention by the speech language pathologist (SLP) through application of compensatory maneuvers, dietary modifications, and rehabilitative interventions. Further, understanding pretreatment organ function may influence determination of the oncologic treatment approach most appropriate to maximize overall function and quality of life in post-treatment. Understanding which patients are at highest risk for dysphagia prior to treatment may assist in allocation of resources in the most efficient and cost-effective way. The intent of this article was to discuss patient variables associated with swallowing dysfunction in HNCA patients prior to intervention.

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MATERIALS AND METHODS

Medical records of participants were reviewed in compliance with the Health Insurance Portability and Accountability Act and in accordance with previous approval by the Johns Hopkins and Medical College of Georgia institutional review

TABLE I.
Patient Characteristics (N = 204).

	No. (%)
Age, yr	
≤40	11 (5)
40–60	109 (54)
60–80	74 (36)
>80	10 (5)
Sex	
Male	169 (83)
Female	35 (17)
Race	
Black	158 (77)
White	36 (18)
Hispanic	3 (1.5)
Asian	4 (2)
Middle Eastern	3 (1.5)
Primary stage*	
T1/T2	138 (68)
T3/T4	65 (32)
Primary site	
Oral cavity	41 (20)
Oropharynx	97 (48)
Larynx	44 (22)
Hypopharynx	8 (4)
Nasopharynx	9 (4)
Unknown	5 (2)

*Data was not known for one patient with a true unknown primary. Patients with unknown primary disease whose tumors were positive for human papillomavirus in situ hybridization were classified as T1/T2.

boards. Consecutive patients with newly diagnosed HNCA comprised the study population. At both institutions, pretreatment evaluations with an SLP are considered the standard of care for individuals with HNCA, which includes instrumental swallowing evaluations (Fiberoptic Endoscopic Evaluation of Swallowing [FEES] or Videofluoroscopic Swallowing Study [VFSS]). All of the study patients received a pretreatment SLP evaluation as part of their routine work-up. The primary swallowing outcome variable chosen was the Penetration Aspiration Score (PAS). This scale is an 8-point nominal ranking of entrance of material into the laryngeal vestibule and patient response to this material, as previously described by Rosenbek et al.⁸ Lower scores reflect more normal function. PAS scores were defined as an ordinal variable (scores ≥ 3 were abnormal, whereas those < 3 were considered normal) as well as a nominal variable.

Data were analyzed using Stata 10 (StataCorp, College Station, TX). Standard regression diagnostics including LOWESS (locally weighted scatterplot smoothing) were used to interrogate the data. Bivariate statistical analysis, including the unpaired *t* test for continuous data, and χ^2 tests for categorical data were used to compare groups. Multiple logistic regression analysis was used to identify factors associated with abnormal PAS scores. Significance was attributed to a $P < .05$.

RESULTS

The study population included 204 consecutive individuals with newly diagnosed HNCA (Table I). The

mean age of participants was 57 years (range, 16–95 years). Patients were predominantly male (83%) and African American (77%). Earlier T stage (T1–T2) was more common (68%) as were oropharyngeal primaries (48%).

Mean PAS scores varied according to primary site and tumor size. Patients with advanced T-stage laryngeal and hypopharyngeal tumors had higher mean PAS scores (5.18, standard deviation [SD] = 2.6) in contrast to early stage larynx/hypopharynx (1.93, SD = 2.1) (Fig. 1). In contrast, patients with advanced T-stage oral cavity and oropharynx primaries did not have higher mean PAS scores (2.24, SD = 2.0) than those with early stage oral cavity and oropharyngeal tumors (1.54, SD = 1.3, $P < .116$).

Significant differences were found between those individuals with normal versus abnormal PAS scores (Table II). Abnormal PAS scores (≥ 3) were more common in individuals with higher T stage ($P < .0001$). Additionally, site of disease was significantly different between the groups ($P = .001$). Multivariate logistic regression analysis of factors associated with abnormal PAS scores revealed that primary site and T stage were the only significant variables associated with abnormal PAS scores after controlling for all other variables (Table III). Patients with laryngeal and hypopharyngeal primaries and those with advanced stage tumors (T3–T4) had poorer pretreatment PAS scores.

DISCUSSION

Instrumental swallowing evaluation can be accomplished through VFSS or FEES. We judge these tools to be complimentary and feel that both have an important role in the assessment of swallowing abilities of individuals with HNCA. Videofluoroscopy is generally considered the standard tool for assessment of oropharyngeal disorders due to its ability to provide visualization of the coordinated stages of swallowing and specific physiologic findings. In addition, use of VFSS allows for evaluation of the esophageal aspect of swallowing when indicated. In contrast, FEES provides the benefits of avoiding radiation exposure, a flexible service delivery model, and direct visualization of relevant anatomy. Investigation of the comparability of these tools has revealed high levels of agreement, sensitivity, specificity,

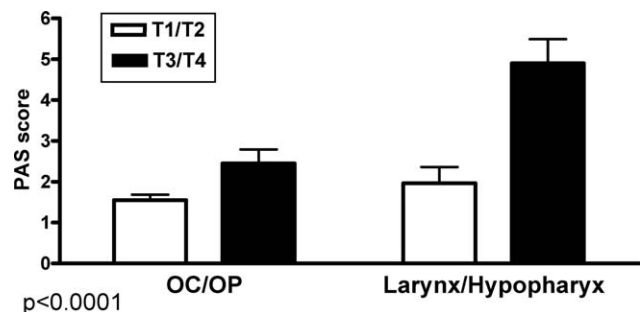


Fig. 1. Penetration Aspiration Score (PAS) by primary site and tumor stage. Data represent the mean \pm standard error of mean. OC = oral cavity; OP = oropharynx.

TABLE II.
Characteristics of Individuals With Head and Neck Squamous Cell Cancer With Normal and Abnormal Penetration Aspiration Scores Prior to Oncologic Management.

	Normal PAS, No. (%)	Abnormal PAS, No. (%)	P Value
Age, yr			.582
≤40	9 (6)	2 (4)	
40–60	85 (55)	24 (49)	
60–80	55 (35)	19 (39)	
>80	6 (4)	4 (8)	
Sex			.489
Male	130 (84)	39 (80)	
Female	25 (16)	10 (20)	
Race			.236
Black	123 (79)	35 (71)	
White	23 (15)	13 (27)	
Hispanic	2 (1)	1 (2)	
Asian	4 (3)	0	
Middle Eastern	3 (2)	0	
Primary stage*			<.0001
T1/T2	118 (77)	20 (41)	
T3/T4	36 (23)	29 (59)	
Primary site			.001
Oral cavity	30 (19)	11 (22)	
Oropharynx	82 (53)	15 (31)	
Larynx	28 (18)	16 (33)	
Hypopharynx	2 (1)	6 (12)	
Nasopharynx	8 (5)	1 (2)	
Unknown	5 (3)	0	

*Data was not known for one patient with a true unknown primary. Patients with unknown primary disease whose tumors were for human papillomavirus by in situ hybridization were classified as T1/T2.

PAS = Penetration Aspiration Score.

and positive and negative predictive values.⁹ The FEES evaluation has also been shown to demonstrate greater sensitivity to laryngeal penetration and aspiration when compared with VFSS.¹⁰

We have found in our institutions that use of a FEES evaluation as part of the multidisciplinary HNCA evaluation yields important information without the need to schedule additional appointments or expose patients to unnecessary radiation. A thorough FEES evaluation conducted by an experienced SLP and otolaryngologist can provide anatomic and physiologic information, assessment of swallowing abilities across viscosities and textures, and implementation of compensatory postures and strategies when dysfunction is identified. We have found that integrating this practice into the standard assessment of newly diagnosed HNCA patients has streamlined patient care and contributed to clinical decision making. When necessary, VFSS can be added to answer additional questions regarding issues such as physiology or esophageal dysfunction. VFSS may also be required in cases where significant alteration of anatomy due to tumor precludes adequate visualization of structures of interest for swallowing.

Previous series have demonstrated increased risk of dysphagia and aspiration in individuals with advanced T-stage, laryngeal, and hypopharyngeal tumors following oncologic management.^{11,12} This study demonstrates that aspiration risk is elevated for these individuals, even in the pretreatment state. This finding highlights the importance of pretreatment and instrumental assessment of swallowing ability in patients with HNCA. Such assessment allows for identification of individuals in need of intensive rehabilitation efforts prior to, during, or after oncologic management. Additionally, for individuals found to have dysfunctional larynges, decision making regarding most oncologic treatment may suggest that organ preservation approaches may not yield ideal functional outcomes.

Our findings are consistent with the data reported by Stenson et al.¹³ regarding higher incidence of aspiration pretreatment in patients with laryngeal and hypopharyngeal primary tumors. This finding is not surprising when considering the mechanical and functional impact of tumors in this region. Certainly, supraglottic laryngeal tumors may preclude vestibular closure at the epiglottic and/or ventricular fold levels leading to inadequate supraglottic airway protection, and thus penetration of the vestibule. Similarly, glottic lesions may impact glottic competence either through tumor obstruction of closure or vocal fold motion impairment. As tumor size expands, so does the risk of airway compromise. In regard to hypopharyngeal tumors, involvement of the pharyngeal constrictors may impact efficiency of bolus clearance into the esophagus, placing patients at elevated risk for penetration and aspiration,

TABLE III.
Multivariate Logistic Regression Analysis of Variables Associated With an Abnormal Penetration Aspiration Score on Pretreatment Swallowing Evaluation.

	Odds Ratio	95% CI	P Value
Age, yr			
≤40	1.00	—	
40–60	0.72	0.12–4.31	.720
60–80	0.69	0.11–4.27	.694
>80	1.89	0.20–17.59	.573
Race			
White	1.00	—	
Black	1.22	0.50–2.98	.654
Hispanic	1.45	0.10–19.16	0.776
Sex			
Male	1.00	—	
Female	1.17	0.44–3.07	.747
Primary site			
OC/OP	1.00	—	
Larynx/HP	3.04	1.41–6.54	.004
T stage			
T1/T2	1.00	—	
T3/T4	3.83	1.83–8.00	<.001

CI = confidence interval; OC = oral cavity; OP = oropharynx; HP = hypopharynx.

particularly after the primary swallow. The higher PAS scores in these individuals not only reflect increased risk of material entering the vestibule, but also reduced patient sensation and response to the material. The inclusion of PAS scores in this series, rather than ranking aspiration as present/absent allows greater consideration of the severity of vestibule invasion and patient response to such events.

Patients with oral and oropharyngeal primary sites had less evidence of bolus entry into the laryngeal vestibule. Again, considering the anatomic region and potential physiologic impacts of tumors in this region, this was not a surprising finding. Patients with oral cavity tumors may experience more pain, problems with oral bolus manipulation and control, and difficulty with mastication; however, such deficits typically will not lead to laryngeal penetration or aspiration. Only a small number of patients with oral cavity tumors (27% of all oral cavity patients) were found to have abnormal PAS scores. Similarly, only 15% of those individuals with oropharyngeal primaries had abnormal PAS scores prior to treatment. Although relatively fewer patients with these primary sites had abnormal PAS findings, the numbers are still high enough to suggest the clinical benefit of routine pretreatment assessment of all patients with HNCA.

This study is an important contribution to the growing evidence supporting the need for pretreatment evaluation of all HNCA patients. Even in the lower-risk groups, abnormal PAS scores were identified >10% of the time, indicating the clinical relevance and appropriateness of such evaluations. Although this may appear to be a low proportion of patients, poor lung function and overall health in patients with HNCA may predispose patients to complications. Therefore, early identification of all patients is critical to minimize long-term health complications associated with chronic aspiration. If these individuals demonstrate such dysfunction prior to treatment, it is critical to know this information to minimize further dysfunction related to treatment effects.

We propose that integration of the fiberoptic endoscopic swallowing evaluation into the multidisciplinary team evaluation provides an excellent opportunity for patient evaluation, education, and intervention. Although supportive of the importance of pretreatment swallowing assessment, this series does not correlate pretreatment scores with post-treatment outcomes.

Although we suspect that those with pretreatment dysfunction are at greater risk for difficulties after treatment, this has not been established in the current data set. Important considerations for future work would be correlating pre- and post-treatment function, correlating function with quality of life both before and after treatment, and identifying predictive outcome variables that may be present in the pretreatment setting.

CONCLUSION

This series demonstrates that swallowing dysfunction in high-risk patients may be present in the pretreatment state and should be considered when determining candidacy for organ preservation modalities. These data highlight the importance of instrumental swallowing evaluations prior to intervention for HNCA, particularly for those individuals with advanced stage, laryngeal, and hypopharyngeal tumors.

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