Improving outcomes in veterans with oropharyngeal squamous cell carcinoma through implementation of a multidisciplinary clinic

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ABSTRACT: *Background.* Treatment of head and neck cancer is complex, and a multidisciplinary clinic may improve the coordination of care. The value of a head and neck multidisciplinary clinic has not yet been established in oropharyngeal squamous cell carcinoma (SCC).

Methods. A retrospective review was conducted of Veterans Affairs patients with oropharyngeal SCC undergoing concurrent chemoradiation before and after implementation of the head and neck multidisciplinary clinic.

Results. Fifty-two patients before and 54 patients after multidisciplinary clinic were included in this study. Age, tobacco use, and p16+ status were similar between groups. With multidisciplinary clinic, time to treatment decreased, and utilization of supportive services, including speech pathology, dentistry, and nutrition increased. The 5-year disease-specific survival rate increased from 63% to 81% ($p = .043$) after implementation of the multidisciplinary clinic. Multivariate analysis showed that disease stage ($p = .016$), p16 status ($p = .006$), and multidisciplinary clinic participation ($p = .042$) were predictors of disease-specific survival.

Conclusion. Implementation of a multidisciplinary clinic improved care coordination and disease-specific survival in patients with oropharyngeal SCC. © 2017 Wiley Periodicals, Inc. *Head Neck* **39:** 1106–1112, 2017

KEY WORDS: oropharyngeal squamous cell carcinoma, multidisciplinary care, survival, treatment outcomes

INTRODUCTION

Despite an overall drop in cancer rates of 23% in the last 25 years, the incidence of oropharyngeal squamous cell carcinoma (SCC) is rising; recent estimates show oropharyngeal SCC accounts for 2.8% of all newly diagnosed cancers.[1,2] This is due to the continuing epidemic of human papillomavirus (HPV)-associated oropharyngeal cancers, which have risen 225% since the mid-1980s. This increase is projected to continue for decades to come, even with a decline in oropharyngeal SCC related to tobacco and alcohol use.[3] Although HPV-associated oropharyngeal SCC carries an improved prognosis relative to traditional tobacco-related oropharyngeal SCC, the long-term survival of patients is dramatically worse in those who also have a significant history of tobacco use.[4] In addition, oropharyngeal SCC and the treatments used for this disease have significant adverse effects upon numerous basic functions and quality of life, including speech, swallowing, breathing, dental and oral health, self-image, and social interactions. Thus, the current standard of care in oropharyngeal SCC treatment involves numerous specialists, including head and neck surgeons, radiation oncologists, medical oncologists, dentists, speech-language pathologists, dieticians, palliative care experts, social workers, and others. Patients frequently need to meet with at least 4 to 5 clinicians before initiating treatment and resource requirements are high. A significant burden is passed to patients in the form of numerous clinic visits and lengthy trips to centers where advanced treatments can take place, which can increase the risk of delays in cancer treatment initiation and further add to the distress of frequently symptomatic patients and their caregivers.

The population of patients served within the Veterans Administration healthcare system in the United States poses several challenges in the treatment of oropharyngeal SCC. In particular, veterans tend to have more chronic health diseases, more frequent tobacco and alcohol use, and other psychological or socioeconomic problems compared to the general population.[5–10] These factors have the potential to adversely impact patient care, particularly for a complex multidisciplinary treatment such as that required for oropharyngeal SCC. At the Veterans Affairs Portland Oregon Health Care System (VAPORHCS), a multidisciplinary head and neck cancer clinic was established in 2007 in an attempt to minimize complexities surrounding

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the coordination of care for patients, families/caregivers, and clinicians when treating head and neck cancers. In this clinic, patients are routinely seen by a head and neck surgeon, radiation oncologist, medical oncologist, speech language pathologist, nutritionist, social worker/cancer care navigator, and palliative care physician as indicated. In addition to convenience for patients, it also gives clinicians opportunities to collaborate face-to-face when formulating treatment strategies for this complex disease.

Previous studies have addressed multidisciplinary clinics and their ability to decrease time from diagnosis to treatment in head and neck cancer, although these studies have not consistently shown improvement in treatment or functional outcomes.[11,12] Although decreased time to treatment is important, the question remains whether or not utilizing a multidisciplinary clinic may provide advantages beyond simply streamlining the process and decreasing the number of office visits for patients. In order to address this question, we examined veterans with oropharyngeal SCC treated with definitive radiotherapy before and after the implementation of a dedicated head and neck multidisciplinary clinic. Our veteran population provides a uniform and high-risk population[13] to study the effect of a multidisciplinary clinic for oropharyngeal SCC on timeliness of care, supportive care measures, and treatment outcomes.

MATERIALS AND METHODS

After institutional review board approval, a retrospective analysis was performed on patients with head and neck cancer seen in the VAPORHCS otolaryngology clinic between 2003 and 2011. Patients were included in the study if they met the following criteria: (1) previously untreated oropharyngeal SCC (stages I–IVb); (2) definitive radiotherapy with or without concurrent chemotherapy with curative intent; and (3) minimum follow-up of 5 years. Patients were excluded if they underwent therapeutic surgical intervention before radiation or if palliation was the primary goal of care (either for metastatic stage IVc disease or patient declined definitive treatment). There was no exclusion based on patient demographics or other factors. Patients included for analysis were divided into 2 cohorts, before and after implementation of an integrated multidisciplinary clinic in September 2007. Data collected included patient demographics, comorbidities, tumor classification, time to completion of multidisciplinary evaluation, treatments, feeding tube use, and survival. Long-term feeding tube use was defined as patients requiring a feeding tube greater than 1 year. Feeding tube placement was considered reactive if it occurred after initiation of radiotherapy. In 2005, intensity-modulated radiotherapy (IMRT) became available for treatment of these patients; before this time, 3D reducing lateral fields was typically used for treatment. In the context of radiotherapy, treatment breaks are defined as an interval in which the therapeutic dosing of radiation could not be accomplished, which caused deviation from the initial schedule. Beginning in 2006, oropharyngeal SCC pathologic samples were routinely tested for p16 status as a surrogate marker for HPV-related oropharyngeal SCC. For patients diagnosed before 2006, archived pathology specimens were sectioned and p16 immunohistochemistry scoring was performed to match current clinical standards.

TABLE 1. Overall patient characteristics stratified by treatment modality.

Characteristics	Traditional model $n = 52$	Multidisciplinary clinic $n = 54$	Multidisciplinary clinic p value
Age, y			
Mean (± SD)	62 (± 11)	62 (± 6)	1
Cancer stage			.682
II	3 (6%)	1 (2%)	
III	8 (15%)	10 (19%)	
IVA	38 (73%)	42 (78%)	
IVB	3 (6%)	1 (2%)	
Risk factors			
Tobacco >10 y	39 (75%)	41 (76%)	.913
p16+ tumor status	24/29 (83%)	34/45 (75%)	.769
Charlson Comorbidity Index			.318
0–1	36 (69%)	42 (81%)	
2–4	16 (31%)	12 (19%)	

Primary outcomes measured were: (1) interval from the time of cancer diagnosis to the time of multidisciplinary evaluation (head and neck surgery, radiation oncology, medical oncology, speech pathology, and dentistry); (2) interval from the time of cancer diagnosis to the time of treatment initiation; and (3) disease-free and overall survival. Secondary outcomes measured included: (1) rates and durations of percutaneous feeding tubes; and (2) rates of palliative care consultation in the patients who died of oropharyngeal SCC.

Descriptive statistics were performed on all variables of interest. Continuous variables were expressed as means with SDs. Premultidisciplinary and postmultidisciplinary clinic patient cohorts were compared utilizing a 2-tailed t test. Categorical variables were expressed as frequencies and analyzed using chi-square analysis. Kaplan–Meier curves were created to assess survival outcomes, and comparison of curves was performed using a log-rank (Mantel–Cox) calculation. A p value of $\leq .05$ was considered significant in all analyses. Multivariate analysis of variables predicting disease-specific survival was also performed. A preliminary univariate analysis was performed utilizing logistic regression. All covariates having a p value $< .2$ were eligible for inclusion in the model. Covariates were then eliminated in a backward stepwise fashion, with only those reaching a p value $< .1$ were allowed to remain in the final model for analysis. Model fit was tested via the Hosmer–Lemeshow method. All statistical testing was performed with the SPSS Statistical Software version 22 (IBM, Armonk, NY).

RESULTS

A total of 106 patients were identified with oropharyngeal SCC and treated with definitive radiotherapy +/- chemotherapy between 2003 and 2011 at the VAPORHCS. Fifty-two patients were seen before initiation of the multidisciplinary clinic, utilizing a traditional consult service model, and 54 patients were treated utilizing the multidisciplinary clinic model (Table 1). Both cohorts were comprised entirely of male patients with the mean age at diagnosis of 62 years. There were no statistical differences between cohorts with respect to stage of cancer (73% stage

TABLE 2. Mean time intervals (days) from pathological tissue diagnosis to endpoints.

Characteristics	Traditional model $n = 52$	Multidisciplinary clinic $n = 54$	p value
No. of radiation oncology consults	52 (100%)	54 (100%)	1
Days to consult (± SD)	25 (± 23)	18 (± 11)	**.016**
Days to treatment (± SD)	58 (± 42)	48 (± 18)	.105
No. of medical oncology consults	45 (87%)	53 (98%)	**.03**
Days to consult (± SD)	32 (± 34)	19 (± 15)	**.014**
Days to treatment (± SD)	66 (± 54)	48 (± 19)	**.029**
No. of speech language pathology consults	50 (96%)	54 (100%)	.238
Days to consult (± SD)	42 (± 42)	18 (± 12)	**< .001**
No. of dental consults	42 (81%)	51 (94%)	**.04**
Days to consult (± SD)	30 (± 25)	22 (± 15)	.061
No. of gastrostomy tubes placed	47 (90%)	50 (93%)	.74
Days to gastrostomy placement (± SD)	50 (± 44)	34 (± 18)	**.02**
No. of social work consults	45 (87%)	53 (98%)	**.029**
Days to consult (± SD)	32 (± 49)	20 (± 15)	.083
No. of nutrition consults	50 (96%)	54 (100%)	.238
Days to consult (± SD)	35 (± 45)	25 (± 20)	.16

Figures in boldface indicate statistical significance.

IVa traditional, 78% stage IVa multidisciplinary clinic; $p = .682$), p16 tumor status (83% positive vs 75% positive; $p = .769$), tobacco use (75% vs 76%; $p = .913$), or Charlson Comorbidity Index (69% vs 81% score 0–1; $p = .318$). The median follow-up for patients before implementation of the multidisciplinary clinic was 64 months, and 63 months for patients treated through the multidisciplinary clinic ($p = .125$).

With implementation of the multidisciplinary clinic, there were statistically significant improvements in time from diagnosis to evaluation by head and neck surgery, radiation oncology, medical oncology, and speech language pathology, and more patients received dental consultations (Table 2). There was also an increase in the number of patients seen by medical oncology with the multidisciplinary clinic. Although the start of radiation treatment occurred on average 10 days earlier after multidisciplinary clinic implementation, this was not statistically significant. Improved coordination of concurrent chemoradiation was also observed: on average, chemotherapy started several days after radiation treatment before the multidisciplinary clinic, whereas these treatments on average started concurrently after implementation of the multidisciplinary clinic (Table 2).

There was no difference in the percentages of patients completing therapy or mean radiation dose administered (Table 3). Of those who completed radiotherapy, there was no difference in treatment breaks or therapy duration. There was no statistically significant difference in 5-year overall survival when comparing patients treated with 3D reducing lateral fields versus those treated with IMRT (50% vs. 67%; $p = .203$).

Similar proportions of patients in each cohort underwent chemotherapy after consultation with medical oncology (Table 4). There was no difference in planned chemotherapy regimens, with the majority of patients receiving cisplatin on treatment days 1, 22, and 43. There was no difference between cohorts in the number of patients completing all 3 cycles of chemotherapy. A change in practice occurred from 2009 to 2010, in which patients who could not complete cisplatin therapy received weekly carboplatin for the remainder of their radiation treatment. This resulted in 10 of the 39 patients (26%) initially started on cisplatin ultimately receiving subsequent carboplatin therapy. The average number of cycles of carboplatin these patients received was 2.9. When examined, 70% of the patients receiving cisplatin with subsequent carboplatin were alive at 5 years, whereas those receiving only cisplatin 66% were alive at 5 years, which was not significantly different ($p = .858$).

There was no difference in proportions of patients receiving placement of a gastrostomy tube between the 2 cohorts, with 90% receiving placement before and 93% receiving one after implementation of the multidisciplinary clinic ($p = .739$). Interval to tube placement from initial diagnosis decreased from 50 days (±44 days) to 34 days (±18 days; $p = .02$). Most gastrostomy tubes were placed prophylactically, before the start of treatment. Before the multidisciplinary clinic, 10% of tubes were

TABLE 3. Radiation treatment summary.

Characteristics	Traditional model $n = 52$	Multidisciplinary clinic $n = 54$	p value
Type of radiation			**< .001**
IMRT	34	54	
3D RLs	16	0	
OLs	1	0	
Uncertain	1	0	
Mean Gy delivered overall (± SD)	66 (± 12)	69 (± 5)	.093
Completed therapy	46 (88%)	49 (91%)	.703
Duration of treatment, days (± SD)	50 (± 6)	49 (± 9)	.487
Required treatment break	5 (11%)	4 (8%)	.327

Abbreviations: IMRT, intensity-modulated radiotherapy; 3D RLs, 3D reducing laterals; OLs, opposed laterals.
Figures in boldface indicate statistical significance.

TABLE 4. Chemotherapy treatment summary.

Characteristics	Traditional model $n = 52$	Multidisciplinary clinic $n = 54$	p value
Medical oncology consult	$n = 45$	$n = 53$	
Patients undergoing chemotherapy	42 (93%)	53 (100%)	.093
Standard chemotherapy regimen*			
Started cisplatin-based therapy	34 (81%)	39 (74%)	.467
Completed cisplatin-based therapy	13 (38%)	10 (26%)	.254
Average cycles received (± SD)	2.33 (± 0.72)	2.03 (± 0.71)	.065

* Scheduled cisplatin 100 mg/m∧2 on days 1, 22, and 43 during radiotherapy.

placed reactively, whereas 0% were placed reactively after the start of the multidisciplinary clinic ($p = .022$). The rate of long-term feeding tube use (>1 year) in these cohorts decreased from 47% to 18% after multidisciplinary clinic implementation ($p = .005$). There was no difference in feeding tube duration 223 days (±190 days) to 200 days (±97 days; $p = .538$), when considering patients who had eventual feeding tube removal. Of the 12 patients who received 3D reducing lateral radiotherapy, only 4 had their feeding tubes removed (33%), whereas 56 of the 78 patients (72%) who underwent IMRT had feeding tubes eventually removed ($p = .008$).

Disease-specific survival improved after implementation of the multidisciplinary clinic. Although overall survival was greater in the multidisciplinary clinic cohort, this was not statistically significant (see Figure 1). Five-year overall survival was 58% in the premultidisciplinary clinic cohort and 67% in the postmultidisciplinary clinic cohort ($p = .297$), whereas 5-year disease-specific survival was 63% in the premultidisciplinary clinic cohort and 81% in the postmultidisciplinary clinic cohort ($p = .043$). This pattern was reproduced when examining only patients with stages IVA and IVB cancer, with a statistically significant improvement in disease-specific survival seen in the multidisciplinary clinic cohort (see Figure 2). For stages IVA and IVB cancer, 5-year overall survival was 51% in the premultidisciplinary clinic cohort and 70% in the postmultidisciplinary clinic cohort ($p = .072$), whereas the 5-year disease-specific survival was 54% in the premultidisciplinary clinic cohort and 81% in the postmultidisciplinary clinic cohort ($p = .009$). A subgroup analysis of patients with p16+ tumors was conducted, and this demonstrated that overall survival was not significantly improved with implementation of the multidisciplinary clinic, from 63% to 69% ($p = .464$). Analysis of disease-specific survival in patients with p16+ disease showed improvement from 67% to 83% with multidisciplinary clinic implementation, although this did not reach statistical significance ($p = .115$; see Figure 3). Finally, multivariate analysis was performed to determine the variables responsible for 5-year disease-specific survival in all patients. Of all variables tested, only disease stage, p16 status, and participation in the multidisciplinary clinic were found to be predictive of disease-specific survival (Table 5).

Of those patients with oropharyngeal SCC who died of disease during the study period before initiation of the multidisciplinary clinic, only 12 of these 19 patients (63%) had received a palliative care consult. After implementation of the multidisciplinary clinic, all 10 of the patients, who eventually died of disease, received consultation with palliative care, resulting in a statistically significant improvement in utilization ($p = .030$).

DISCUSSION

As oropharyngeal SCC continues to rise in incidence, a multidisciplinary approach to patient care is critical to provide both optimal treatment outcomes and minimize treatment-related morbidity. An integrated, multidisciplinary clinic allows clinicians to standardize and streamline

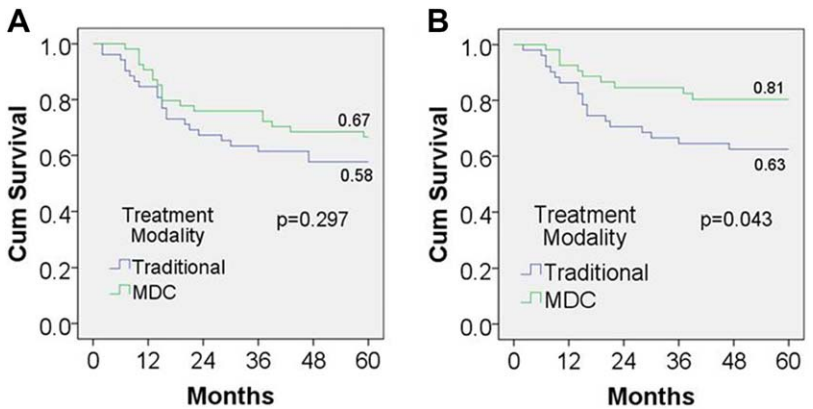

FIGURE 1. All patients (A) overall and (B) disease-specific survival. MDC, multidisciplinary clinic. [Color figure can be viewed at wileyonlinelibrary.com]

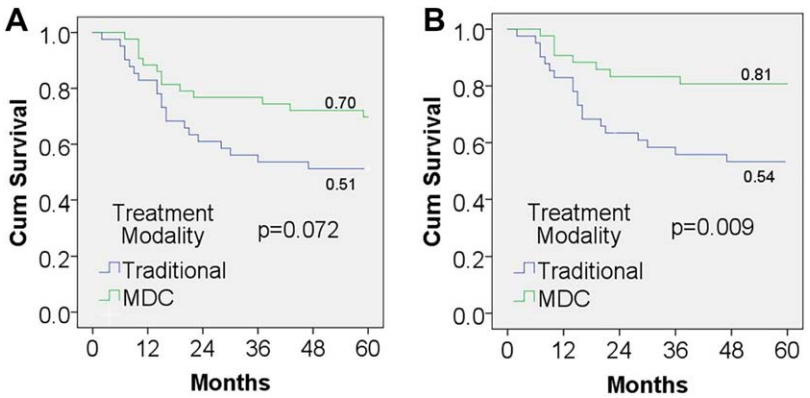

FIGURE 2. Stage IV tumor overall (A) and disease-specific (B) survival. [Color figure can be viewed at wileyonlinelibrary.com]

the pathway to treatment. The direct face-to-face interaction of multiple providers and patients in a single clinic has been shown to change treatment recommendations in gastrointestinal malignancies[14] and urologic malignancies,[15] among others. A multidisciplinary clinic has also been shown to reduce patient wait times and improve survival in hepatocellular carcinoma.[16] Given the number of specialties that play a role in the treatment of patients with head and neck cancer, a head and neck multidisciplinary clinic represents an opportunity to improve team-based decision-making and streamlining the patient experience. However, implementation of a multidisciplinary clinic is a significant challenge, requiring coordination of provider time, scheduling, and proper infrastructure and facilities to allow it to function. The use of a multidisciplinary clinic is particularly important in the Veterans Affairs Health System, given the medical and socioeconomic complexity of these patients, as well as recent criticism of this system for long wait times and treatment delays.[17]

For head and neck cancer, a previous study of a multidisciplinary clinic at a Veterans Affairs hospital demonstrated a reduction in time intervals to initiation of treatment.[11] Similarly, our study demonstrated improvements in the time to consultation with multiple specialties as well as improved time to the start of cancer treatment. This reduction in time to treatment is significant, as recent reports have shown that the time to treatment initiation for head and neck cancer in the United States is increasing.[18] However, the impact of time to treatment is somewhat controversial. It has previously been shown that increasing interval to treatment up to 90 days did not impact survival on a large cohort of patients with head and neck cancer,[19] although, in a small cohort of oropharyngeal SCC patients, a delay in treatment of 34 days allowed for a 70% increase in tumor burden and 23% of the patients had a subsequent increase in cancer stage.[20] A large-scale analysis of the National Cancer Database showed that increased time to treatment initiation, particularly if extended beyond 60 days, significantly reduced survival.[21] Thus, in addition to improving time to treatment initiation, it is reasonable to hypothesize that a head and neck multidisciplinary clinic may also impact survival.

In this study, we not only showed that the implementation of a multidisciplinary clinic improved time to consultation and treatment from the date of diagnosis and increase utilization of other services, such as speech pathology and dentistry, but that this translated into a significant improvement in disease-specific survival for patients compared with those treated in the previous standard consult-based approach. Multivariate analysis confirmed that treatment through the multidisciplinary clinic was an independent predictor of long-term disease-specific survival, although not statistically significant,

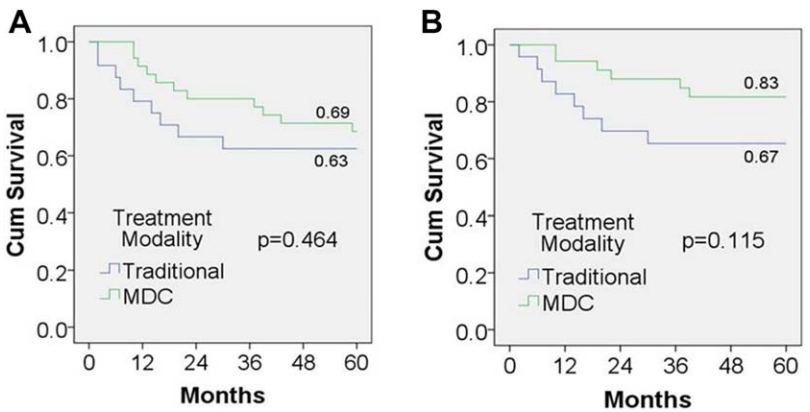

FIGURE 3. P16+ (A) overall and (B) disease-specific survival. MDC, multidisciplinary clinic. [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 5. Multivariate analysis of disease-specific survival.

Model factors	Odds ratio	95% Confidence interval			Hosmer–Lemeshow Model fit
		Lower	Upper	*p* value	
Multidisciplinary clinic	0.37	0.14	0.96	**.042**	
Stage IV	7.23	1.44	36.38	.016	
p16+	0.23	0.08	0.65	.006	0.801

Figures in boldface indicate statistical significance.

5-year overall survival showed a trend in improvement as well. Furthermore, when only patients with stages IVA to IVB disease were examined, these survival advantages became more apparent. This survival advantage also seems independent of tumor p16 status, as a clinically significant (although not statistically significant, likely because of the reduced sample size) improvement in disease-specific survival was seen in the p16+ tumor subgroup analysis. This finding suggests that, in patients with higher risk disease and higher likelihood for treatment-related morbidity, the positive effects of an integrated, team-based multidisciplinary clinic approach are magnified.

Other studies have examined the utilization of a multidisciplinary clinic in head and neck cancer treatment. Implementation of a multidisciplinary clinic in an unselected head and neck veteran population has been shown to improve time to treatment initiation but did not demonstrate a survival advantage.[11] This is likely because of heterogeneity of the study population, which examined all head and neck cancer subsites across a variety of cancer stages. It is possible that the heterogeneity introduced in that study obscured a potential survival advantage. In contrast, the current study compares a very homogenous population in which both cohorts are comprised exclusively of patients with oropharyngeal SCC, with nearly identical distributions of age, stage, HPV prevalence, smoking history, and treatment modalities. Similarly, a cohort study from China examined 1616 patients with oral cavity cancer treated primarily with surgery and was able to demonstrate survival advantage and increased compliance with adjuvant therapy when utilizing a multidisciplinary clinic.[12] Taken together, these data suggest that the implementation of a multidisciplinary clinic can have a positive effect on survival.

We were able to demonstrate additional benefits to veteran patients with oropharyngeal SCC treated in a multidisciplinary clinic model. We observed a reduction in long-term gastrostomy tube use from 47% to 18% after multidisciplinary clinic implementation. Feeding tube dependence has been shown to correlate with survival,[22] and this may, in part, account for the improved survival observed in our patient population. Importantly, in our study, patients who ultimately died of their disease were significantly more likely to have a consult with a palliative care physician after implementation of the multidisciplinary clinic. Patient and caregiver depression scores were recently shown to decrease when utilizing palliative care in patients with cancer,[23] and there are data that early use of palliative care significantly improves patient quality of life and survival.[24]

This study had several limitations. Given the retrospective nature of the study, there was no standardization in treatment or outcome measures, thereby limiting the data available. Treatment for oropharyngeal SCC also evolved slightly during the study period. In 2005, we saw implementation of IMRT from previously used 3D reducing lateral fields. Comparisons between these 2 techniques have not demonstrated differences in locoregional control, although toxicity-associated morbidity is lower with the use of IMRT.[25] Although we did not observe a statistically significant difference in survival when comparing 3D reducing lateral field radiation to IMRT, there may have been a clinically significant difference that may contribute to the survival advantage seen in the postmultidisciplinary clinic cohort. Patients in the postmultidisciplinary clinic cohort also received a slightly higher total radiation dose, although this was not statistically significant. Additionally, although the majority of patients had similar chemotherapy regimens, roughly 25% of the patients required modification to their chemotherapy treatment because of treatment-related toxicities. Changes in treatment over time could have contributed to the differences in outcomes that we observed. This study was also limited by the volume of oropharyngeal SCC treated at the VAPORHCS and the interval required to include data on 5-year follow-up. A larger cohort may have been able to better define the potential differences between care-model groups. Furthermore, many potential benefits of the multidisciplinary clinic, such as improved patient and provider satisfaction, are difficult, if not impossible, to measure in a retrospective study. Finally, as this study was conducted entirely within the Veterans Administration, the results may not necessarily be generalizable to all patients with oropharyngeal SCC.

Despite these limitations, this study demonstrates a significant improvement in both time to treatment and disease-specific survival for veterans with oropharyngeal SCC treated in a multidisciplinary clinic. In addition, the head and neck multidisciplinary clinic may improve long-term functional outcomes (as evidenced by decreased permanent feeding tube use) and provide better care for patients with terminal disease (as evidenced by increased utilization of palliative care consultation). These findings suggest that establishing a multidisciplinary clinic is worth the investment in time and resources for creation, implementation, and maintenance. It is important to note that patients included in the multidisciplinary clinic at our institution are highly selected. All patients included had an established cancer diagnosis, had completed tumor staging, and had multidisciplinary tumor board recommendation for treatment. The benefits of a multidisciplinary clinic may be difficult to achieve in a less selected population given the high resource utilization needed, namely provider time. Future studies on other head and

neck cancer subsites are needed to better define the benefit of a multidisciplinary clinic as applied to the broader head and neck cancer population, and to better understand the impact of a multidisciplinary clinic on short-term and long-term functional outcomes for the increasing number of head and neck cancer survivors.

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