Diagnostic Pathway of Oral Cavity Cancer in an Integrated Health Care System

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ABSTRACT

Context: Survival for patients with oral cavity squamous cell carcinoma (OCSCC) has remained relatively stagnant despite advances in treatment. Few studies have examined why advanced-stage disease is diagnosed in 40% of patients with OCSCC nationally.

Objective: To characterize the diagnostic pathway of OCSCC in an integrated health care system.

Design: Retrospective study of patients with OCSCC (2007-2010).

Main Outcome Measures: Referral patterns and demographic, clinical, and tumor characteristics associated with time to diagnosis (diagnostic interval).

Results: Of 247 patients, 167 (68%) had early-stage (I/II) disease, 86 (35%) were referred by dentists, and 70 (28%) had a history of premalignancy. The median time (interquartile range) from symptom onset to care sought from a primary care physician (patient interval), from primary care physician to otolaryngologist, and from otolaryngologist to diagnosis was 8.6 (4.0-25.8), 1.0 (0.6-3.1), 0.0 (0.0-3.0) weeks, respectively. These intervals did not differ by demographic characteristics, clinical factors, or tumor stage. Prolonged diagnostic intervals were observed among patients with premalignant lesions.

Conclusion: The patient interval was the largest component of the total diagnostic interval. The subsequent professional workup proceeded relatively efficiently. Prolonged diagnostic interval in patients with premalignant lesions may reflect the natural history of malignant transformation rather than a delay in diagnosis. However, nearly one-fourth of these cases were diagnosed at an advanced stage; closer surveillance may represent an opportunity for diagnosis at an earlier stage. Surveillance for premalignant lesions and facilitating referrals from dentists may expedite the diagnosis and treatment of OCSCC. Further investigation is warranted.

INTRODUCTION

Survival for squamous cell carcinoma of the oral cavity has not improved greatly since the 1980s, despite tremendous research efforts and advancements in technology.[1] One reason for this may be the stable rate of diagnosis at advanced-stage disease.[1] Unlike other, more common cancers, which have benefited from cancer screening and earlier detection, efforts toward improving earlier diagnosis of oral cavity squamous cell carcinoma (OCSCC) have been relatively limited.

Proper examination of most of the upper aerodigestive tract requires flexible endoscopic equipment, which is rarely available outside the otolaryngologist's office. However, the oral cavity allows for relatively easy visualization without special instrumentation. Despite this accessibility, 40% of oral cavity cancers are still diagnosed with regionally metastatic disease and 6% with distant metastatic disease.[1] Not only does late-stage disease portend a poorer survival compared with early-stage disease, treatment of late-stage disease entails much more extensive treatment and results in a poorer quality of life.[2-6]

Opportunities to reduce diagnostic delays in oral cavity cancer may exist for which detecting more disease at an earlier stage could result in improved survival and reduced morbidity. Few studies have examined the diagnostic pathway of oral cavity cancer and assessed whether delays commonly occur in the US population. In a large population cohort of patients with OCSCC, this study aims to 1) measure the patient and professional time intervals to diagnosis (diagnostic intervals) and the factors associated with these intervals, 2) identify risk factors associated with late-stage disease presentation, and 3) examine the referral patterns of patients with oral cavity cancer to an otolaryngologist.

METHODS

A retrospective cohort study was conducted in Kaiser Permanente Northern California (KPNC), a large integrated health care system. The cohort was composed of unique cases of oral cavity tumors diagnosed from January 1, 2007, through December 31, 2010. These cases were identified from a source population obtained from the KPNC Cancer Registry by the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) site and histology codes. The KPNC Cancer Registry is a database containing all verified in situ and invasive cancers from KPNC medical facilities reported to the California Cancer Registry and the Survival, Epidemiology, and End-Results (SEER) program of the National Cancer Institute.

A total of 462 cases of oral cavity cancers were identified in the KPNC Cancer Registry. Fifty-one cases did not meet the following inclusion criteria: Age at diagnosis of 18 years or older, tumor

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histology of squamous cell carcinoma, and ICD-O-3 site code specific for the oral cavity. A systematic chart review was then conducted to exclude cases caused by a second primary tumor, tumor recurrence, or misdiagnosed subsite, or if the documentation was deemed inadequate to determine patient and professional diagnostic intervals (n = 105). A final series of criteria was applied to the unique 306 OCSCC cases, allowing for the further exclusion of patients whose tumor was identified as a carcinoma in situ, who saw an oral surgeon or non-KPNC otolaryngologist/head and neck surgeon before the KPNC primary care physician (PCP) or otolaryngologist, who were not treated, or who were missing data on patient diagnostic interval. The final sample consisted of 247 cases (Figure 1).

Demographic and lifestyle data were obtained from the KPNC Cancer Registry and the electronic medical record, including sex, age at tumor diagnosis, race/ethnicity, tobacco use history, and alcohol intake history. Clinical history data included tumor subsite, dental referral status, primary presenting symptom, presence of premalignant lesions, neck dissection status, treatment received, and final disease state.

Additional temporal data were collected on the time between a patient's first symptoms and the date when the patient presented to the PCP (patient interval), the time from the initial PCP visit until the date of pathologic diagnosis (professional interval), the combined total diagnostic time from patient symptoms to the date of pathologic diagnosis (diagnostic interval), and the total time from first symptom to time of treatment (total interval). Definitions used for patient and professional diagnostic intervals were consistent with those used in prior studies.[4,7-10] When this information was not available in the PCP's documentation, the patient diagnostic interval was extrapolated from the otolaryngologist's notation.

Tumor Stages I, II, III, and IV were derived from the tumor, node, metastasis (TNM) classification system, according to the American Joint Committee on Cancer (AJCC),[11] and ascertained from the KPNC Cancer Registry using the North American Association of Central Cancer Registries' nationally standardized software algorithm and verified using chart review. If TNM staging was not available in the KPNC Cancer Registry, a chart review was conducted to assign the clinical stage.

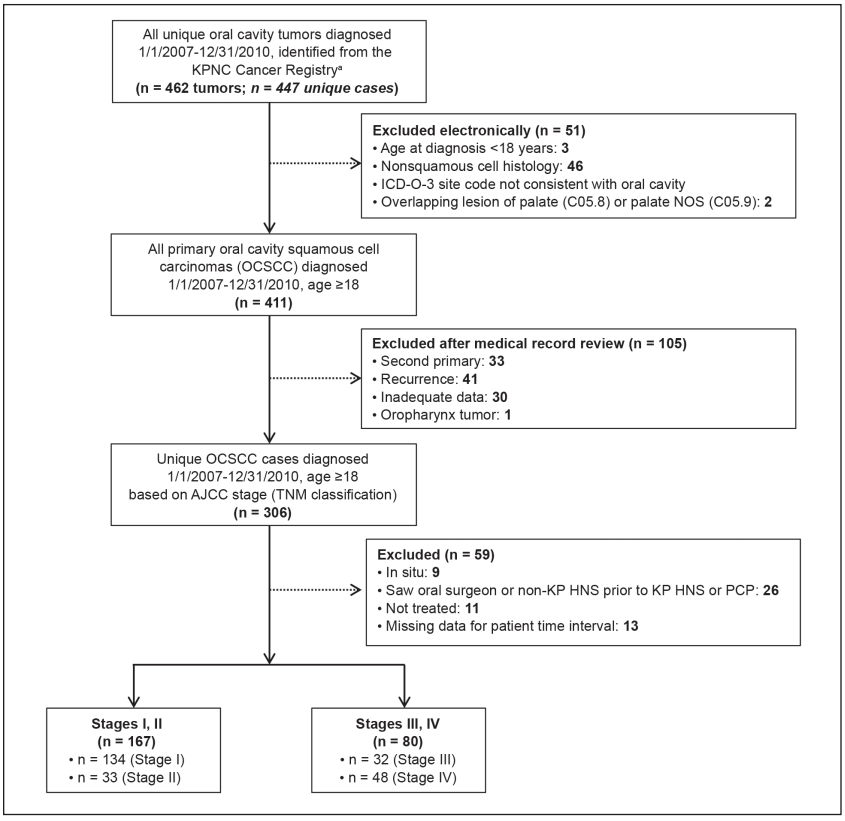

Figure 1. Cohort assembly of oral cavity squamous cell carcinomas diagnosed, 2007 to 2010.

[a] Initially identified by SEER sites (recode values): 20020 = tongue; 20040 = floor of mouth; 20050 = gum/other mouth.
AJCC = American Joint Committee on Cancer; ICD-O-3 = International Classification of Diseases for Oncology, Third Edition; KP HNS = Kaiser Permanente head and neck surgeon; KPNC = Kaiser Permanente Northern California; NOS = not otherwise specified; PCP = primary care physician; SEER = Survival, Epidemiology, and End-Results Program; TNM = tumor, node, metastasis.

Descriptive statistics were generated for the 247 OCSCC cases, to examine frequency distributions of demographic (sex, age, race/ethnicity), lifestyle (tobacco and alcohol intake history), and clinical characteristics (tumor stage, tumor subsite, referred by dentist, primary presenting symptoms, presence of premalignant lesions, neck dissection status, treatment received, and final disease state). Descriptive statistics also were generated to examine measures of dispersion for the different intervals (patient, professional, treatment, diagnostic, and total). Bivariate analyses were used to assess variations in early stage (Stages I and II) vs late tumor stage (Stages III and IV) and intervals according to demographic, lifestyle, and clinical characteristics. Chi-square tests were used to compare categorical variables. *T*-tests and nonparametric tests (Wilcoxon rank sum or Kruskal-Wallis) were used to compare continuous variables. All analyses were conducted using statistical software (SAS 9.3, SAS Institute Inc, Cary, NC). The Kaiser Foundation Research Institute's institutional review board approved this study with a waiver of consent.

RESULTS

Demographic, lifestyle, and clinical characteristics of the 247 unique OCSCC cases are presented overall and according to tumor stage (Tables 1 and 2). Two-thirds (67.7%, n = 167) of the cases had

early-stage disease, including 54.3% with Stage I (n = 134) and 13.4% with Stage II (n = 33). One third (32.4%) had late-stage disease, including 13.0% with Stage III (n = 32) and 19.4% with Stage IV (n = 48). Approximately half of the cases were men (53.4%), and more than half (56.6%) were older than age 60 years. The mean age was 64.2 years (standard deviation = 14.3 years) at tumor diagnosis, with a range from age 20 years to older than age 90 years. The cohort was composed predominantly of white patients (77.3%), followed by Asian/Pacific Islanders (12.6%). Most cases had a history of tobacco use (17.8% were current users, and 43.7% were former users) and of alcohol consumption (45.3% were current drinkers, and 10.5% were former drinkers). None of the demographic or lifestyle characteristics were associated with tumor stage.

Regarding clinical characteristics, the most common oral cavity tumor subsites were the tongue (61.9%) and floor of mouth (16.2%). The most common primary presenting symptoms were tongue pain and lesions (61.1%) and floor-of-mouth lesions in the nontongue category (12.2%). More than one-third (35%) of cases involved a referral by a dentist. History of a premalignant lesion was reported for 70 cases (28.3%), and of these, 17 (24.3%) presented with late-stage disease at the time of diagnosis. Leukoplakia and dysplasia were the most common types of lesions (60% and 16%, respectively). Approximately half (51.3%) of patients with late-stage tumor died during follow-up, compared with 28.1% of those with early-stage tumor ($p < 0.0001$).

Among the 247 OCSCC cases, 213 had complete data for the number of weeks from their initial PCP visit until the first otolaryngologist visit (presumably after referral). All other intervals include all 247 cases. Between the onset of symptoms and the initial visit to the PCP, 119 cases (48%) had a delay of more than 3 months (12 weeks). Patients experienced symptoms for a median of 8.6 weeks (range = 0-520 weeks; interquartile range (IQR) = 4.0-25.8) before presenting to the PCP (Table 3). This initial period, before the patient engaged with the medical system, contributed the most time on the pathway to treatment.

Between the first clinician visit to the PCP (or directly to the otolaryngologist for the 34 patients who "bypassed" the PCP) and the date of pathologic (tumor) diagnosis, 65 patients (26%) had a delay of more than 2 months (8 weeks). The median elapsed time between the initial presentation to a PCP and the tumor diagnosis, the professional diagnostic interval (Table 3), was only 2 weeks (IQR = 0.6-8.6), with the median time from the PCP to the otolaryngologist occurring within 1 week (IQR = 0.6-3.1), and the median time from the otolaryngologist visit to the tumor diagnosis occurring on the same day (0 weeks, IQR = 0-3.0; data not shown). The median time from when the tumor diagnosis took place to the time of initial treatment was 3.9 weeks (IQR = 2.6-5.9), contributing to a total interval from symptom onset to treatment of 21.1 weeks (IQR = 11.0-54.0), as shown in Table 3.

There were no significant differences in the underlying distributions of the various intervals, according to demographic and lifestyle characteristics or tumor stage (Table 3). However, differences were seen among patients who were initially referred by a dentist, compared with those who were not referred by a dentist, for the diagnostic interval (median = 25.8 weeks, IQR = 11.7-52.9 weeks; vs 13.9 weeks, IQR = 5.3-39.1 weeks; $p = 0.02$) and for total interval (median = 29.4 weeks, IQR = 15.7-56.0 weeks; vs 17.8 weeks, IQR = 10.0-45.2 weeks; $p = 0.03$). Patients with premalignant lesions, compared with those without, had a longer professional interval (median = 7.9 weeks, IQR = 1.0-53.0; vs 1.4 weeks, IQR = 0.3-4.6; $p < 0.0001$) and diagnostic interval (median = 43.2 weeks, IQR = 12.6-113.2 weeks; vs 13.8 weeks, IQR = 5.3-32.6; $p < 0.0001$). Patients with premalignant lesions also had a longer total interval (median = 46.2 weeks, IQR = 16.8-120.3 weeks; vs 18.0 weeks, IQR = 10.0-39.7 weeks; $p < 0.0001$).

Table 1. Demographic characteristics of 247 oral cavity squamous cell carcinoma cases

Characteristic	Total (n = 247), no. (%)	Tumor stages[a] I, II (n = 167), no. (%)	Tumor stages[a] III, IV (n = 80), no. (%)	p value
Sex				0.6328
Men	132 (53.4)	91 (54.5)	41 (51.3)	
Women	115 (46.6)	76 (45.5)	39 (48.8)	
Age at tumor diagnosis, years				0.8458
< 50	38 (15.4)	27 (16.2)	11 (13.8)	
50-69	112 (45.3)	74 (44.3)	38 (47.5)	
≥ 70	97 (39.3)	66 (39.5)	31 (38.8)	
Mean age at tumor diagnosis, years (SD)	64.2 (14.3)	64.4 (14.6)	63.8 (13.7)	0.7868
Race/ethnicity				0.1143
White	191 (77.3)	134 (80.2)	57 (71.3)	
Nonwhite[b]	56 (22.7)	33 (19.8)	23 (28.8)	
Tobacco use history				0.3930
Never	95 (38.5)	67 (40.1)	28 (35.0)	
Former[c]	108 (43.7)	74 (44.3)	34 (42.5)	
Current[d]	44 (17.8)	26 (15.6)	18 (22.5)	
Alcohol intake history				0.5846
None (abstainer)	78 (31.6)	51 (30.5)	27 (33.8)	
Former	26 (10.5)	15 (9.0)	11 (13.8)	
Current	112 (45.3)	79 (47.3)	33 (41.3)	
Unknown	31 (12.6)	22 (13.2)	9 (11.3)	

[a] Tumor stage based on the American Joint Committee on Cancer's Tumor, Nodes, Metastases (AJCC/TNM) classification.
[b] Includes African American (n = 6), Asian/Pacific Islander (n = 31), Hispanic (n = 18), and other race/ethnicity (n = 1).
[c] Includes cigarettes (n = 99), cigars (n = 5), and chewing tobacco (n = 4).
[d] Includes cigarettes (n = 41), cigars (n = 2), and pipe (n = 1).
SD = standard deviation.

DISCUSSION

Our study, conducted in a diverse integrated health care delivery system, is one of the first from the medical literature to investigate diagnostic pathways in oral cavity cancer within a US population. The time between the patient's initial symptoms and the first encounter with the PCP accounted for most of the delay in diagnosis and ultimately treatment. A statistically significant portion (28%) of patients had a previous diagnosis of a premalignant condition, and 35% were referred by a dentist. These findings support further investigation into avenues to reduce diagnostic delay, including surveillance of patients with premalignant lesions and streamlining of the dentist-otolaryngologist specialist referral process.

The patient interval was found to be the largest component of the total diagnostic interval, a finding consistent with similar studies.[7,12,13] We found no significant variations in the underlying distributions of patient intervals by early and late-stage disease; patients presenting at all stages waited a median of 8.6 weeks before initially seeing their PCP. This lack of relationship between diagnostic delays and stage of disease at initial presentation has been observed not only in studies of head and neck cancers[14] but also in studies of other cancer subsites, including colorectal, lung, endometrial, and cervical cancers.[15-18] In fact, for some cancers such as medulloblastoma, it has been found that shorter intervals from patient onset of symptoms to clinical presentation are correlated with a decreased survival.[15] Some cancer investigators have proposed that tumor growth rate, rather than patient diagnostic interval, is the preeminent factor that affects the stage of presentation. It is hypothesized that tumor growth rate has a greater influence on stage of presentation rather than the period of symptoms.[15,18] Fast-growing cancers might present with short symptom intervals and late-stage disease, whereas slow-growing cancers might present with mild symptoms that the patient disregards for some time, but the cancer remains early stage when diagnosed. Late-stage tumors are theorized to express more overt symptoms including pain and bleeding, are more conspicuous on clinical examination, and are less likely to be misdiagnosed, which may paradoxically shorten diagnostic intervals for late-stage disease.[16] In the oral cavity, this confounding factor may explain why we failed to find a temporal relationship between diagnostic intervals and stage of disease. However, earlier diagnosis allows treatment initiation of fewer cancer cells, increasing treatment success.

After patients with OCSCC presented to the PCP, their subsequent management was performed efficiently. The median time from PCP to otolaryngologist and from otolaryngologist to diagnosis was 1 week (IQR = 0.6-3.1 weeks) and 0 weeks (IQR = 0-3.0 weeks), respectively. This diagnostic efficiency may reflect the advantages of an integrated health care system, where the PCPs can call specialists during the initial patient visit and arrange for same-day appointments when clinically indicated. The median time from diagnosis to treatment was 3.9 weeks, which is similar to data from the National Cancer Database.[19] That national study of more than 50,000 patients with head and neck cancer found that a treatment delay of 2 weeks was associated with worse survival.[19] Although the study did not report information pertaining to the diagnostic intervals, one can infer that decreasing diagnostic delays may confer survival benefit as well.

Table 2. Clinical and tumor characteristics of 247 oral cavity squamous cell carcinoma cases

Characteristic	Total (n = 247), no. (%)	Tumor stages[a] I, II (n = 167), no. (%)	Tumor stages[a] III, IV (n = 80), no. (%)	p value
Tumor subsite (ICD-O-3 coding system)				0.7719
Cheek, other mouth	24 (9.7)	14 (8.4)	10 (12.5)	
Floor of mouth	40 (16.2)	26 (15.6)	14 (17.5)	
Gum	22 (8.9)	14 (8.4)	8 (10.0)	
Hard palate	8 (3.2)	6 (3.6)	2 (2.5)	
Tongue	153 (61.9)	107 (64.1)	46 (57.5)	
Was referred by dentist				0.1659
No	161 (65.2)	104 (62.3)	57 (71.3)	
Yes	86 (34.8)	63 (37.7)	23 (28.8)	
Site of primary presenting symptom				0.0077
Nontongue[b]	76 (30.8)	56 (33.5)	20 (25.0)	
Tongue	151 (61.1)	103 (61.7)	48 (60.0)	
Neck	10 (4.1)	2 (1.2)	8 (10.0)	
Other[c]	10 (4.1)	6 (3.6)	4 (5.0)	
Had premalignant lesion				0.0870
No	177 (71.7)	114 (68.3)	63 (78.8)	
Yes	70 (28.3)	53 (31.7)	17 (21.3)	
Underwent neck dissection				< 0.0001
No	115 (46.6)	98 (58.7)	17 (21.3)	
Yes	132 (53.4)	69 (41.3)	63 (78.8)	
Treatment received				
Surgery	229 (92.7)	162 (97.0)	67 (83.8)	0.0002
Chemotherapy	65 (26.3)	23 (13.8)	42 (52.5)	< 0.0001
Radiation therapy	110 (44.5)	47 (28.1)	63 (78.8)	< 0.0001
Final disease state				0.0001
Alive without disease	146 (59.1)	114 (68.3)	32 (40.0)	
Alive with disease	13 (5.3)	6 (3.6)	7 (8.8)	
Died	88 (35.6)	47 (28.1)	41 (51.3)	

[a] Tumor stage based on the American Joint Committee on Cancer's Tumor, Nodes, Metastases (AJCC/TNM) classification.
[b] Includes cheek lesion (n = 10), floor-of-mouth lesion (n = 30), gum lesion (n = 26), and palate lesion (n = 10).
[c] Includes dysphagia (n = 1), jaw pain (n = 6), otalgia (n = 2), and unknown primary presenting symptom (n = 1).
ICD-0-3 = International Classification of Diseases for Oncology, Third Edition.

Seventy patients (28.3%) were given a diagnosis of a premalignant lesion before the OCSCC diagnosis. The premalignant diagnoses include leukoplakia (diagnosed clinically), dysplasia (diagnosed with biopsy), and lichen planus. The professional interval was longer for these patients; however, this may reflect the natural history of malignant transformation rather than a delay in diagnosis. Nearly one-fourth (24.3%) of these patients with known premalignant lesions received a subsequent diagnosis of late-stage disease. The treatment and surveillance of premalignant lesions was not captured in our data collection; however, anecdotally, management seemed to be performed in variable fashion. Patients with known premalignant lesions may represent an opportunity for improvement through prevention or closer surveillance and detection of disease at an earlier stage.

Table 3. Patient, professional, diagnostic, and total time intervals[a] in weeks for OCSCC cases, median (interquartile range)

Characteristic	Patient interval	p value[b]	Professional interval[c]	p value[b]	Diagnostic interval	p value[b]	Total interval	p value[b]
Overall	8.6 (4.0-25.8)	—	2.0 (0.6-8.6)	—	16.6 (6.0-52.0)	—	21.1 (11.0-54.0)	—
Demographic/lifestyle								
Sex		0.57		0.49		0.76		0.98
Men	8.6 (3.0-25.8)		2.2 (0.6-6.6)		15.3 (6.2-52.3)		20.4 (11.6-55.6)	
Women	12.0 (4.3-25.8)		2.0 (0.6-12.0)		17.5 (6.0-49.6)		23.2 (10.3-53.2)	
Age at tumor diagnosis, years		0.24		0.51		0.20		0.36
< 50	15.1 (4.3-52.0)		2.1 (0.7-4.9)		28.5 (7.3-55.0)		35.0 (11.7-59.6)	
50-69	8.6 (4.3-18.5)		2.3 (0.7-8.4)		17.1 (6.5-42.4)		22.5 (11.5-45.1)	
≥ 70	8.6 (3.5-25.8)		2.0 (0.3-10.0)		14.5 (4.9-42.4)		18.3 (10.7-47.3)	
Race/ethnicity		0.20		0.59		0.16		0.18
White	12.9 (4.3-25.8)		2.1 (0.6-9.9)		17.9 (6.3-52.6)		23.6 (11.5-55.6)	
Nonwhite	7.6 (3.0-15.0)		2.0 (0.6-4.8)		11.9 (5.5-39.4)		16.0 (10.4-42.9)	
Clinical								
Tumor stage (AJCC/TNM classification)		0.47		0.16		0.48		0.79
Stages I/II	8.6 (4.0-25.8)		2.4 (0.7-11.1)		17.2 (6.3-52.9)		21.1 (11.0-55.7)	
Stages III/IV	12.3 (4.3-25.8)		1.7 (0.4-5.7)		14.6 (5.4-38.7)		21.2 (10.9-43.4)	
Tumor subsite (ICD-O-3 coding system)		0.60		0.73		0.43		0.29
Cheek, other mouth	12.9 (4.5-25.8)		0.9 (0.2-20.2)		28.5 (10.3-48.9)		35.0 (18.2-52.6)	
Floor of mouth	12.9 (4.3-25.8)		2.0 (0.8-6.3)		16.1 (5.6-57.9)		20.8 (11.2-59.9)	
Gum	10.1 (3.5-17)		2.4 (0.3-8.4)		14.4 (8.7-27.8)		17.9 (14.9-30.2)	
Hard palate	3.7 (2.5-24.5)		1.1 (0.7-2.3)		7.1 (4.1-27.1)		10.6 (6.7-30)	
Tongue	8.6 (4.0-25.8)		2.7 (0.6-10.7)		16.8 (6.3-52.9)		22.4 (10.7-55.6)	
Was referred by dentist		0.16		0.47		0.02		0.03
Yes	12.9 (4.3-25.8)		2.4 (0.3-12)		25.8 (11.7-52.9)		29.4 (15.7-56.0)	
No	8.6 (3.5-25.8)		2.0 (0.6-8.1)		13.9 (5.3-39.1)		17.8 (10.0-45.2)	
Site of primary presenting symptoms		0.001		0.12		0.001		0.02
Nontongue	12.9 (4.3-25.8)		1.4 (0.3-7.5)		17.4 (7.9-44.5)		23.4 (12.1-48.3)	
Tongue	8.6 (4.3-30.1)		3.0 (0.6-11.6)		18.1 (6.9-54.7)		24.6 (11.5-57.6)	
Neck	2.0 (1.0-3.0)		2.1 (1.4-2.7)		4.1 (3.7-5.9)		10.7 (10.0-14.9)	
Other	3.0 (0.5-8.6)		0.6 (0-3.1)		8.4 (3.0-31.1)		12.2 (5.9-33.4)	
Had premalignant lesion		0.34		< 0.0001		< 0.0001		< 0.0001
Yes	12.9 (4.0-52.0)		7.9 (1.0-53.0)		43.2 (12.6-113.2)		46.2 (16.8-120.3)	
No	8.6 (4.3-24.0)		1.4 (0.3-4.6)		13.8 (5.3-32.6)		18.0 (10.0-39.7)	

[a] Patient interval is the time from the patient's first symptoms to presentation to their primary care physician (PCP). Professional interval is the time from the initial PCP visit until the patient was seen by a head and neck surgeon (HNS) specialist and the time from the initial HNS visit until the tumor diagnosis. Diagnostic interval is the combined time of the patient and professional intervals. Total interval is the combined time of the patient and professional intervals and the time from the tumor diagnosis until the first tumor-directed treatment (median = 3.9 weeks, interquartile range = 2.5-5.9 weeks).

[b] From Wilcoxon rank sum test or Kruskal-Wallis nonparametric test.

[c] There are missing data on the number of weeks from the initial PCP visit until the first HNS visit (presumably after referral) for 34 patients. These individuals apparently were seen by the HNS first.

AJCC/TNM = American Joint Committee on Cancer's Tumor, Nodes, Metastases; ICD-0-3 = International Classification of Diseases for Oncology, Third Edition; OCSCC = oral cavity squamous cell carcinoma.

Dentists played a key role in our case population, referring more than one-third of the patients (35%) for evaluation, although this referral process is often not coordinated directly in our Health Plan. Inferring from the PCP records, it appears that dentists most often encouraged patients with suspicious oral lesions to see their PCP, and rarely was direct communication between the PCP and the dentist documented in the health record. Furthermore, timing of the dental visit was generally not recorded, and therefore the time between the dental visit and first PCP visit is unknown and may represent a substantial professional delay. Also, among the 121 cases (of the 306 retained after completion of medical record review; Figure 1) referred by dentists, 18% were referred to oral surgeons for biopsy when oral cavity cancer was suspected. In our health care environment, although oral surgeons sometimes perform biopsies, they rarely treat oral cavity cancers. These referrals, therefore, created an unnecessary additional step in the diagnostic pathway, allowing more opportunities for delayed patient presentation.

The American Dental Association recommends that patients receive routine oral examinations at least once a year.[20] Although the US Preventive Services Task Force states that there is insufficient evidence to recommend oral cavity cancer screening,[21] opportunistic screening examinations by dental professionals exhibit promise as an avenue to improve identification of disease and shorten the interval between symptoms of disease and initial visit with a PCP. Although the American Dental Association does not recommend any formal OCSCC screening, it does recommend that dentists and dental hygienists "remain alert for signs of potentially malignant lesions or early-stage cancers in all patients while performing routine visual and tactile examinations, particularly for patients who use tobacco or who are heavy consumers of alcohol."[22] Two studies from the UK demonstrated that dental professionals had diagnostic sensitivities of 71% and 74%, respectively, in identifying oral cavity premalignant and malignant lesions.[23,24] Surveys demonstrate that dentists are more knowledgeable concerning symptoms and signs of oral cavity cancer compared with PCPs[25] and play a vital role in the detection of OCSCC. With 62% of American adults actually seeing their dentist every year,[26] encouraging these preventive dental visits, especially for patients at high risk of OCSCC, may help in the earlier detection of suspicious lesions. Partnering with our dental colleagues and enabling them to directly refer patients to an otolaryngologist specialist may reduce diagnostic delay.

Several limitations should be noted in the interpretation of our findings. First, because of the retrospective nature of our study, there may be patient recall bias in the reporting of the duration and quality of their symptoms. Patient intervals were, at times, documented with vague language, when symptom duration was recorded with nebulous language such as "a few" or "a couple." This was best mitigated by assigning standard numerical values to each term, which were kept consistent throughout the study. Furthermore, data for patient risk factors regarding tobacco and alcohol use were not consistently documented, hence precluding meaningful analysis of these factors.

The strengths of this study include that it is one of the first to comprehensively assess the diagnostic pathways for oral cavity cancer within a large US community-based integrated health care delivery system serving a diverse patient population. Study of diagnostic delay is difficult in other American practice settings and from other data sources. At many academic centers, a large proportion of their cases are diagnosed elsewhere, and therefore the data regarding their diagnostic pathway may not be readily available. National databases such as SEER and the National Cancer Database do not collect data before the date of diagnosis. The integration of our system allows for coordination of services between the PCPs and the otolaryngologists. Use of KPNC's integrated electronic medical record with linkage to electronic databases and disease registries allowed for accurate capture of demographic and professional diagnostic intervals, which were further validated by chart review.

CONCLUSION

The patient diagnostic time interval has shown to be the largest component of the total diagnostic interval. Once patients presented to the physician, the diagnostic pathway proceeded relatively efficiently. Patients with premalignant lesions should be regularly monitored to increase the likelihood of diagnosis at early stages of disease as well as early treatment of the tumor after pathologically confirmed diagnosis. Collaborating with dentists and streamlining the referral process to otolaryngologists may be an avenue to screen patients for malignancy that merits further investigation. ❖

Disclosure Statement

The authors have no conflicts of interest to disclose.

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