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CANCER STATISTICS

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Epidemiological study of malignant tumors in the oral and maxillofacial region: survey of member institutions of the Japanese Society of Oral and Maxillofacial Surgeons, 2002

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Abstract We studied 1809 patients with oral cancer who visited and were treated, in 2002, at the 148 institutions certified as training facilities by the Japanese Society of Oral and Maxillofacial Surgeons. Of these institutions, 39 are dental university hospitals, 44 are medical university hospitals, 64 are general hospitals, and for 1 institution, the classification was not known. The patients consisted of 1071 (59.2%) males and 738 (40.8%) females (male: female ratio, 1.45:1), who had a average age of 65.2 years. The tongue (40.2%) was the most common site affected, followed by the gingiva (32.7%), buccal mucosa (10.1%), and oral floor (9.0%). There were 6 cases of multiple intraoral cancers. On histopathological examinations, squamous cell carcinoma (88.7%) was the most common type found, followed by adenoid cystic carcinoma (2.1%), and mucoepidermoid carcinoma (1.7%). Cases classified as T2N0 were the most common (32.1%), followed by T1N0 (21.4%), T4N0 (8.0%), and T2N1 (7.6%). Distant metastasis occurred in 17 patients (1.0%). Nonepithelial tumors, among which malignant melanoma was the most common type, accounted for 1.8% of the tumors.The sizes of the nonepithelial malignant tumors ranged from 1.0 to 7.0 cm, with an average size of 3.7 cm.

Key words Oral cancer · Epidemiological study · Oral surgery

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Introduction

We carried out an epidemiological study of malignant tumors in the oral and maxillofacial region in patients who were treated at member institutions of the Japanese Society of Oral and Maxillofacial Surgeons to determine the status of patients treated by oral surgeons in Japan.

In 1986, a nationwide epidemiological study was conducted in regard to the status of patients with cancer in the oral and maxillofacial region who were treated at member institutions of the Japanese Society of Oral and Maxillofacial Surgeons, and findings from that investigation were first reported in 1988.[1] In 2005, as part of a project established by the Fiscal 2004 Survey Planning Committee (Masashi Shimahara, Chairman; along with members Etsuhide Yamamoto, Harumi Mizuki, Hiroshige Chiba, Yutaka Imai, Shigeyuki Fujita, and Masanori Shinohara) the Japanese Society of Oral and Maxillofacial Surgeons began an annual

survey of patients with cancer in the oral and maxillofacial region who were treated at member institutions of the Society. Prior to that survey, a preliminary investigation had been conducted on oral cancer found in new patients during their initial visit during the 1-year period from January to December 2002. The purpose of the present study was to assess the current situation by investigating results from that 1-year survey performed in 2002, and to analyze the data of those patients with cancer in the oral and maxillofacial region who consulted member institutions of the Society for treatment.

Subjects and methods

The subjects of the investigation were new patients with malignant tumors who visited the member institutions of the Society during the 1-year period from January 1 to December 31, 2002, and who fulfilled the following criteria: (1) histopathologically confirmed malignant tumor; (2) presence of a primary tumor either in the lip and oral cavity (ICD-O C00, C02-C06), maxillary sinus (ICD-O C31.0), salivary gland (ICD-O C07, C08), or other oral regions (ICD-O C41.1) classified according to the *General rules for clinical studies on head and neck cancer*, 3rd edition;[2] (3) previously untreated; and (4) records noting age, sex, tumor location, and tumor size. For the initial registration, a registration form for patients with malignant tumors of the head and neck, prepared by the Japanese Society for Head and Neck Cancer, was sent to the member institutions and used.

Returned registration forms were analyzed for five items. (1) Institutions that participated in the survey were classified into faculties of dentistry and departments of oral surgery of dental colleges (hereinafter, referred to as dental colleges), faculties of medicine and departments of oral surgery of medical colleges (medical colleges), and departments of other types of dentistry and oral surgery, of general hospitals (hospitals). The number of participating institutions and average number of patients treated at each institution were analyzed. (2) Age at the first consultation and sex were analyzed by tumor location. (3) Tumors were classified as malignant epithelial tumors and nonepithelial malignant tumors, such as sarcoma, malignant lymphoma, and malignant melanoma, and analyzed according to age, sex, primary tumor location, and histologic type. For histopathological diagnosis and primary tumor location, the ICD-10 code was used (Tables 1, 2). (4) Malignant epithelial tumors were analyzed according to the number of cases classified as T or N, number of cases by TN classification, number of cases by M classification, and number of tumors by T classification according to tumor location. (5) Nonepithelial tumors were analyzed according to tumor size, which was determined according to the description in the registration form with the maximum diameter expressed in centimeters (after rounding out fractions of centimeters). Tumor size was also analyzed by location, in the lip (C00.0, C00.1, C00.6), tongue (C02.0, C02.1, C02.2, C02.3), gingiva (C03.0, C03.1), oral floor (C04.0, C04.1, C04.9), palate (C05.0), buccal mucosa (C00.3, C00.4, C06.0, C06.1, C06.2), maxillary sinus (C31.0), jawbone (C41.1), and major salivary gland (C07, C08, C08.0, C08.1).

Table 1. Histopathological diagnosis (International Classification of Diseases; ICD-10)

Carcinoma
8000/3: Neoplasm, malignant
8010/3: Carcinoma, NOS
8020/3: Carcinoma, undifferentiated, NOS
8051/3: Verrucous carcinoma, NOS
8052/3: Papillary squamous cell carcinoma
8070/2: Squamous cell carcinoma in situ, NOS
8070/3: Squamous cell carcinoma, NOS
8071/3: Squamous cell carcinoma, keratinizing, NOS
8072/3: Squamous cell carcinoma, large cell, nonkeratinizing
8073/3: Squamous cell carcinoma, small cell, nonkeratinizing
8074/3: Squamous cell carcinoma, spindle cell
8076/2: Squamous cell carcinoma in situ with questionable stromal invasion
8076/3: Squamous cell carcinoma, microinvasive
8140/3: Adenocarcinoma, NOS
8200/3: Adenoid cystic carcinoma
8430/3: Mucoepidermoid carcinoma
8470/3: Mucinous cystadenocarcinoma, NOS
8550/3: Acinar cell carcinoma
8560/3: Adenosquamous carcinoma
8940/3: Mixed tumor, malignant, NOS
8980/3: Carcinosarcoma, NOS
8982/3: Myoepithelial carcinoma, NOS
9270/3: Odontogenic tumor, malignant
Sarcoma
8720/3: Malignant melanoma, NOS
8810/3: Fibrosarcoma, NOS
8830/3: Fibrous histiocytoma, NOS
8890/3: Leiomyosarcoma, NOS
9120/3: Hemangiosarcoma
9180/3: Osteosarcoma, NOS
9240/3: Mesenchymal chondrosarcoma
9590/3: Malignant lymphoma, NOS
9670/3: Malignant lymphoma, small lymphocytic, NOS
9680/3: Malignant lymphoma, large cell, diffuse, NOS
9731/3: Plasmacytoma, NOS
9732/3: Multiple myeloma

There were no cancers with a histopathological diagnosis not listed above

Cases of multiple cancers were analyzed as follows. In the present survey, each malignant tumor was registered in each registration form. Tumors registered under the same patient name, institution case number, date of birth, age at first consultation, sex, and date of first consultation were regarded as being from the same patient. Each patient was treated as a separate case when determining the number of cases, age, and sex. For histopathological diagnosis, T classification, N classification, and site of primary tumor, each registration form was treated as representing a single tumor.

The difference in average age between male and female patients was analyzed using an unpaired *t*-test, with the level of significance set at 5%. For building a database from the registration form data and significant difference tests, JMP version 5.1.2 (SAS Institute, Cary, NC, USA) was used.

Results

Participating institutions

We sent registration forms to 234 institutions – 54 dental colleges, 60 medical colleges, and 120 hospitals. Of the 234 institutions, 148 (63.2%) returned completed registration forms. Classified by kind of institution, hospitals had the highest return rate, as they comprised 43.2% of the institutions that returned the forms, while 39 (26.4%) dental colleges and 44 (29.7%) medical colleges returned the forms. One institution that returned forms was of unknown classification. The average number of patients per institution was 18.7 for dental colleges and 17.5 for medical colleges; these averages tended to be greater than that for hospitals (Table 3).

Table 2. Classification by location (ICD-O)

Lip	C00.9
Upper lip	C00.0
Lower lip	C00.1
Commissure of lip	C00.6
Oral cavity	C06.9
Tongue	
Anterior 2/3 of tongue	C02.3
Dorsal surface of anterior tongue	C02.0
Border of tongue	C02.1
Tip of tongue	C02.1
Ventral surface of tongue	C02.2
Floor of mouth	C04.9
Anterior floor of mouth	C04.0
Lateral floor of mouth	C04.1
Lower gum	C03.1
Upper gum	C03.3
Buccal mucosa	
Mucosa of upper lip	C00.3
Mucosa of lower lip	C00.4
Cheek mucosa	C06.0
Vestibule of mouth (upper)	C06.1
Vestibule of mouth (lower)	C06.1
Retromolar area	C06.2
Hard palate	C05.0
Maxillary sinus	C31.0
Major salivary gland	
Parotid gland	C07
Submandibular gland	C08.0
Sublingual gland	C08.1
Other	C08.9

No cancer was found in locations not listed above

Age, sex, primary tumor location, and age at first visit by tumor location

A total of 2128 registration forms were returned, in which 1809 patients (85.0%) fulfilled all the requirements for registration. Of these, 6 patients had multiple cancers (5 had tumors that developed at two sites, and 1 had tumors at three sites). Accordingly, 1816 tumors in 1809 patients were subjected to analysis.

Males accounted for 1071 (59.2%) patients and females for 738 (40.8%) (male: female ratio, 1.45:1; Table 4). The average age at the first visit was 65.2 ± 13.9 years. The ages ranged from 12 to 99 years, with a median of 67 years. The average age at the first visit was 63.6 ± 13.1 years for males and 67.6 ± 14.5 years for females; thus, age was significantly higher for female patients than for male patients($P < 0.05$). The average age at the first visit was 65.3 ± 13.8 years for patients with malignant epithelial tumors and 59.2 ± 16.5 years for patients with nonepithelial tumors; thus, age was slightly higher for those with epithelial tumors (for age distribution by sex and age group, see Tables 5 and 6).

As for location, 730 (40.2%) tumors developed in the tongue, demonstrating the highest incidence, followed by 594 (32.7%) in the gingiva (223 in the upper, 371 in the lower), 184 (10.1%) in the buccal mucosa, and 164 (9.0%) in the oral floor (Table 7). The ratio of males and females stratified by primary location varied widely. The ratio of male patients was higher for tumors located in the lip, tongue, oral floor, maxillary sinus, and jawbone, while that for female patients tended to be higher for tumors in the gingiva and palate (Table 7). Regarding age at the first visit stratified by primary tumor location, average age was higher in order of the lip, palate, and buccal mucosa, while it tended to be lower for tumors in the jawbone, major salivary gland, and tongue (Table 8). Of the six patients with multiple cancers three were women and three, men, and the age at the first visit was over 75 years for all but one of these patients.

Table 4. Sex distribution

	Epithelial tumors	Nonepithelial tumors	Total
Male	1051	20	1071
Female	726	12	738
Total	1777	32	1809

Table 3. Participating institutions

Institution	Registered institution/ Nominated institution	Average number of patients per institution (range)
Dental universities and faculties of dentistry	39/54	18.7 (2–59)
Medical universities and faculties of medicine	44/60	17.5 (3–41)
Other institutions (general hospitals)	64/120	9.7 (1–45)
Type not known	1/–	12

Registered institutions means those institutions that returned completed registration forms; nominated institutions means the member institutions of the Society

Table 5. Distribution of epithelial tumors by sex and age group (years)

	0–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	90–99	Total
Male	3[a]	8	38	98	225	298	288	79	14	1051
Female	0	12	25	44	98	173	229	119	26	726
Total	3	20	63	142	323	471	517	198	40	1777

[a] Numbers show numbers of patients

Table 6. Distribution of nonepithelial tumors by sex and age group (years)

	0–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	90–99	Total
Male	0[a]	0	1	1	7	4	4	2	1	20
Female	0	2	3	1	0	3	3	0	0	12
Total	0	2	4	2	7	7	7	2	1	32

[a] Numbers show numbers of patients

Table 7. Distribution of tumor location by sex

	Lip	Tongue	Gingiva	Oral floor	Palate	Buccal mucosa	Maxillary sinus	Jawbone	Oral cavity	Major salivary gland	Total
Male	13/0	468/1[a]	281/10	121/0	19/3	99/0	37/3	4/3	2/0	10/0	1054/20
Female	5/0	261/0	295/8	42/1	23/2	85/0	10/0	1/0	1/1	7/0	730/12
Total	18/0	729/1	576/18	163/1	42/5	184/0	47/3	5/3	3/1	17/0	1784/32

[a] Epithelial tumors / Nonepithelial tumors

Table 8. Average age at the first consultation, by tumor location

Location	Lip	Tongue	Gingiva	Oral floor	Palate	Buccal mucosa	Maxillarysinus	Jawbone	Oral cavity	Major salivary gland
Average age (years)	69.6	62.0	68.1	64.6	69.3	69.1	64.1	43.8	62.5	57.9
Number of tumors	18	730	594	164	47	184	50	8	4	17

Table 9. Number of epithelial tumors by location

Location	Lip (18)			Tongue (729)				Gingiva (576)		Oral floor (163)			Palate (42)
	Upper lip	Lower lip	Labial commisure	Dorsal tongue	Lateral tongue	Ventral tongue	Anterior 2/3	Upper gingiva	Lower gingiva	Anterior	Lateral	Not specified	Hard palate
	2	9	7	17	579	101	32	214	362	93	52	18	42

Buccal mucosa (184)					Others (4)	Jawbone and sinus (51)				Major salivary gland (17)			Total
Buccal mucosa	Upper lip	Lower lip	Gingiv-buccal sulcus	Retro molar	Oral cavity	Maxillary sinus	Maxilla	Intra osseous (mandible)	Mandible	Parotid	Subman-dibular	Sublingual	
128	7	4	23	22	4	46	1	3	1	9	6	2	1784

Age, sex, and primary tumor location for epithelial and nonepithelial tumor cases

Epithelial tumor cases

Epithelial tumors were observed in 1777 patients (98.2%), 1051 males (59.1%) and 726 females (40.1%; male: female ratio 1.45:1; Table 5). The average age at the time of the first consultation was 65.3 ± 13.9 years (range, 12-98 years). The age of female patients was significantly higher (67.8 ± 14.3 years) than that of male patients (63.6 ± 13.1 years; $P < 0.05$). Primary tumor locations in these patients showed a tendency similar to that in all of the patients investigated, as tumor incidence was higher in order of the tongue (n = 729; 40.9%), gingiva (n = 576; 32.4%), buccal mucosa (n = 184; 10.3%), and oral floor (n = 163; 9.1%; Table 9).

As for the histopathological diagnosis, squamous cell carcinoma Not otherwise specified (NOS) (8070/3) accounted for the largest proportion (n = 1282; 71.9%) of the 1784 epithelial tumors studied. However, when 329 tumors

Table 10. Histopathological diagnosis of epithelial tumors

Histopathological diagnosis	No. of tumors
8000/3 (Neoplasm, malignant)	13
8010/3 (Carcinoma, NOS)	5
8020/3 (Carcinoma, undifferentiated, NOS)	2
8051/3 (Verrucous carcinoma, NOS)	52
8052/3 (Papillary squamous cell carcinoma)	4
8070/2 (Squamous cell carcinoma in situ, NOS)	27
8070/3 (Squamous cell carcinoma, NOS)	1282
8071/3 (Squamous cell carcinoma, keratinizing, NOS)	273
8072/3(Squamous cell carcinoma, large cell, nonkeratinizing)	11
8073/3 (Squamous cell carcinoma, small cell, nonkeratinizing)	7
8074/3 (Squamous cell carcinoma, spindle cell)	5
8076/2 (Squamous cell carcinoma in situ with questionable stromal invasion)	1
8076/3 (Squamous cell carcinoma, microinvasive)	1
8140/3 (Adenocarcinoma, NOS)	19
8200/3 (Adenoid cystic carcinoma)	39
8430/3 (Mucoepidermoid carcinoma)	31
8470/3 (Mucinous cystadenocarcinoma, NOS)	2
8550/3 (Acinar cell carcinoma)	3
8560/3 (Adenosquamous carcinoma)	2
8940/3 (Mixed tumor, malignant, NOS)	2
8980/3 (Carcinosarcoma, NOS)	1
8982/3 (Myoepithelial carcinoma, NOS)	1
9270/3 (Odontogenic tumor, malignant)	1

Table 11. TN Classification of epithelial tumors

	N0	N1	N2a	N2b	N2c	N3	NX	Total
T0	1[a]	0	0	0	0	0	0	1
Tis	4	0	0	0	0	0	0	4
T1	381	16	2	3	4	0	4	410
T2	572	136	8	29	15	0	5	765
T3	126	43	6	41	13	1	0	230
T4	142	79	18	72	44	9	7	371
TX	2	0	0	0	0	0	1	3
Total	1228	274	34	145	76	10	17	1784

[a] Numbers show numbers of tumors

Table 12. TN classification of M1 cases

	T2	T3	T4	Total
N0	2[a]	1	2	5
N1	1	2	1	4
N2a~c	1	1	2	4
N3	0	0	4	4
Total	4	4	9	17

[a] Numbers show numbers of tumors

Table 13. Distribution of T classification of epithelial tumors by location

	T0	Tis	T1	T2	T3	T4	TX	Total
Lip	0[a]	0	11	6	1	0	0	18
Tongue	0	2	245	339	93	50	0	729
Gingiva	0	1	73	228	66	208	0	576
Oral floor	0	0	35	82	16	30	0	163
Palate	0	0	12	15	1	13	1	42
Buccal mucosa	1	1	33	82	30	37	0	184
Maxillary sinus	0	0	1	6	17	22	0	46
Jawbone	0	0	0	0	1	2	2	5
Oral cavity	0	0	0	1	1	2	0	4
Major salivary gland	0	0	0	6	4	7	0	17
Total	1	4	410	765	230	371	3	1784

[a] Numbers show numbers of tumors

of other types (8052/3, 8070/2,8071/3, 8072/3, 8073/3, 8074/3, 8076/2, and 8076/3) were included in the analysis, 1611 tumors were squamous cell carcinoma (90.3%). Among salivary gland tumors, adenoid cystic carcinoma (8200/3) had the highest incidence (n = 39; 39.4%) followed by mucoepidermoid carcinoma (8430/3) (n = 31; 31.3%) and adenocarcinoma (8140/3) (n = 19; 19.2%; Table 10).

As for T classification, T2 was predominant (n = 765; 42.9%), followed by T1 (n = 410; 23.0%), T4 (n = 371; 20.8%), and T3 (n = 230; 12.9%). For N classification, N0 was predominant (n = 1228; 68.8% 69.1), followed by N1 (n = 274; 15.4%), N2 (n = 255; 14.3%), and N3 (n = 10; 0.6%). For TN classification, T2N0 was the highest (n = 572; 32.1%), followed by T1N0 (n = 381; 21.4%), T4N0 (n = 142; 8.0%), and T2N1 (n = 136; 7.6%; Table 11). For M classification, M1 was observed in 17 cases (1.0%), which were classified by TN classification as follows: 4 cases of T2, 4 cases of T3, and 9 cases of T4. N classification does not contribute to M classification (Table 12). As for histopathological diagnosis of the M1 cases, squamous cell carcinoma NOS (8070/3) was predominant in 11 cases, followed by squamous cell carcinoma keratinizing NOS (8017/3) in 2 cases, and verrucous carcinoma NOS (8051/3), adenocarcinoma NOS (8140/3), adenoid cystic carcinoma (8200/3), and adenosquamous carcinoma (8560/3) in 1 case each.

In a comparison of T classification by location, the initial stages T0, Tis, T1, and T2 accounted for the majority of the tumors in the lip, tongue, palate, and buccal mucosa, while they accounted for half of those in the gingiva. In contrast, advanced stage cases accounted for the majority of tumors located in the maxillary sinus, jawbone, and major salivary gland (Table 13).

Nonepithelial tumors Thirty-two nonepithelial tumors were observed in 32 patients (1.8%), none of whom had multiple tumors. Twenty of these patients (62.5%) were men and 12 (37.5%) were women (Table 4). Their average age at the first consultation was 59.2 ± 16.5 years (range, 27–92 years). Further, the average age of male patients was 63.0 ± 14.0 years and that of females was 52.9 ± 18.9 years.

The location of the primary site was in the maxillary gingiva for 10 tumors (31.3%), while the maxilla had the majority (n = 19; 59.4%) when 4 tumors (12.5%) found in the maxillary sinus and 5 (15.6%) in the hard palate were added. The mandibular gingiva followed, with 8 tumors (25.0%; Table 14). As for the histopathological diagnosis, malignant melanoma (8720/3) accounted for the largest proportion (n = 13; 40.6%), followed by malignant lymphoma (9590/3, 9670/3, 9680/3) (n = 8; 25.0%; Table 15). The size of the tumors ranged from 1 to 7 cm, and averaged 3.7 cm (median, 4 cm). None of the nonepithelial tumors was described by M classification as M1.

Table 14. Number of nonepithelial tumors by location

Location	Tongue (1)	Gingival (18)		Oral floor (1)	Palate (5)	Jawbone and maxillary sinus (7)			Total
	Lateral tongue	Maxillary gingiva	Mandibular gingiva	Anterior	Hard palate	Maxillary sinus	Intraosseous	Mandible	
	1	10	8	1	5	4	2	1	32

Table 15. Histopathological diagnosis of nonepithelial tumors

MMe	FS	MFH	LS	AS	OS	MCS	ML	MMy	PC1	Total
13	1	2	2	1	1	1	8	2	1	32

Mme, malignant melanoma; FS, fibrosarcoma; MFH, malignant fibrous histiocytoma; LS, leiomyosarcoma; AS, angiosarcoma; OS, osteosarcoma; MCS, mesenchymal chondrosarcoma; ML, malignant lymphoma; MMy, multiple myeloma; PC, plasmacytoma

Discussion

The incidence of cancer in the oral and maxillofacial region varies greatly depending on country, region, and ethnic group.[3] Even within the same country and region, incidence by location of primary tumors varies over time.[4] In Japan, a nationwide survey[1] (hereinafter referred to as the 1986 National Survey) was made of 1508 patients treated at 109 oral surgery institutions in fiscal 1986, 16 years prior to the present survey. In addition, the registration of malignant head and neck tumors (hereinafter referred to as the Nara Prefecture Survey) was conduced as a regional cancer registration in Nara Prefecture.[5] In the 1986 National Survey, patient occupation, route of referral, family history of cancer, and comorbidity were investigated.

The present investigation was conducted using the registration form for Head and Neck Cancer (for initial registration) prepared by the Japan Society for Head and Neck Cancer. In this survey, social background and previous diseases were not investigated. As in the 1986 National Survey, the present subjects were patients who had a checkup at a member institution during the 1-year period from January to December 2002, and the survey did not include those who consulted other institutions. Further, 319 registration forms were excluded due to incomplete descriptions. Accordingly, the results of this survey did not cover all oral cancer cases in Japan for the year of study. However, we consider that the findings provide a description of patients who were diagnosed and treated by oral surgeons.

Participating institutions

In comparison to the 1986 National Survey, the number of institutions that participated in the present survey was increased, as registration forms were returned by 148 institutions. Further, participation by departments of dentistry and oral surgery in general hospitals increased, though the number of patients per institution varied widely, from 1 to 59. Characteristically, dental colleges and medical colleges reported nearly the same number of patients, while general hospitals had fewer. We consider that this might be because of the recent increases in numbers of supervisory and specialist oral surgeons, and increases in the number of institutions, as society members, that deal with oral cancers.

Age and sex

The incidence of cancer in the oral and maxillofacial region was more frequent in older patients. It has been frequently reported that the average age at the first consultation was in the 60s for both men and women,[4,6–8] though other reports have noted that cancer cases were more frequently observed in younger patients, in their 40s and 50s.[9,10] However, in a study that compared age over time, it was generally concluded that the number of older patients was increasing.[4,9]

In the 1986 National Survey, patients in their 50s and 60s accounted for the largest proportions, at 25% each, followed by those in their 70s. In the present survey, patients in their 70s were predominant, accounting for 29.0%, indicating an increasing tendency for elderly patients. Especially in women, the number of patients in their 80s was larger than that of those in their 50s, showing an apparent aging trend. In Japan, in patients with cancer in all locations, the ratio of elderly patients (over 70 years old) is tending to increase; it was 39% in 1985 and had increased to 47% in 2000, while it was expected that this proportion would increase to 52% in 2005.[11] As for oral cancer, the proportion of patients over 70 years old was 29.3% in the 1986 National Survey and 42.3% in the present investigation. Thus, it was confirmed that oral cancer is increasing among elderly individuals, similarly to other types of cancer. However, a variety of diseases often coexist in elderly cancer patients, which makes standard treatment difficult and necessitates individualized therapy choices.

Shiboski et al.[12] reported that the proportion of younger patients aged 20–44 years with cancer of the tongue and palatine tonsil was on the increase in the United States. In Scandinavian countries, it was also noted that the number of younger patients with cancer of the tongue showed an increasing tendency.[13] In Japan, patients aged 49 years and younger accounted for 18.1% of the total in the 1986 National Survey, while this age group accounted for 13.0% in the present survey. Further, the number of patients aged 45 years or younger in the present survey amounted to 142 (7.8%), which was a slight decrease from the previous survey. Llewellyn et al.[14] reported that the risk factors for oral cancer in patients aged 45 years or younger were smoking that started at a young age (16 years or younger) and excessive alcohol intake, especially for males, while the

risk factors for females were reported to be hereditary predisposition, virus infection, and sexual activity.[15] In the present survey, no investigation was made regarding habits such as smoking and drinking, though these factors should be examined in a future survey.

Tarvainen et al.[4] reported that age at the first consultation was slightly higher in patients with lip cancer than in those with cancer at other sites of the oral cavity, while Hogan et al.[8] found that age was higher, in the descending order, for cancer of the buccal mucosa, lip, and gingiva. Further, Howell et al.[16] noted that the proportion of patients aged 70 years or older was highest for cancer of the gingiva, followed by lip cancer. In the present survey, the proportion of patients aged 70 years or older was higher, in descending order, for cancer of the lip, buccal mucosa, and palate, confirming that, for patients with lip cancer, the average age at the first consultation was high. However, it was impossible to determine the cause of the high age at first consultation in patients with lip cancer on the basis of the present results. A previous report[4] suggested that there were relationships between the incidence of lip cancer and exposure to ultraviolet light and smoking rate, features which should be examined in a future study.

In the 1986 National Survey, the ratio of males to females among patients with cancer in the oral and maxillofacial region was 1.67:1. However, this ratio varies widely; Iamaroon et al.[6] reported it to be 1.3:1, and Rawashdeh et al.,[7] Ravi et al.,[10] and Hogan et al.[8] reported ratios of 1.77:1, 3.27:1, and 1.73:1, respectively. Shimizu[17] compared survey results for the period from 1930 to 1960 with those of the 1986 National Survey and noted that the ratio of males tended to be higher in the latter survey. Meanwhile, Howell et al.[16] found that the ratio of female patients was increasing over time. In the present survey, the ratio of males to females was 1.45:1, which indicated a slightly higher ratio of female patients as compared to that in the 1986 National Survey. The cause of this increase is not known, though we consider that the following factors may be involved. The age distribution in the present survey, with elderly patients aged 70 years or older accounting for 40% of the subjects, was slightly higher than in the 1986 National Survey. In addition, the proportion of female patients was also higher, and it has been shown, in a national nutrition survey[18] conducted by the Ministry of Health, Welfare and Labor of Japan, that the smoking rate among females has increased slightly, while that of males has decreased. It is considered necessary to continue this type of survey over time.

For the ratio of males to females by tumor location, there have been reports that the male ratio was higher among patients with lip cancer,[4] whereas that of females tended to be higher among those with cancer of the gingiva and salivary gland as compared to patients with cancer at other sites.[16] However, in Japan, cancer of the gingiva, especially the lower gingiva, is frequently seen in male patients.[19] In the present survey, cancer of the lip tended to occur more frequently in males, while that of the gingiva occurred more frequently in females. The factors that affect the ratio of males to females by tumor location are considered to be wide-ranging, and the present results could not elucidate those details.

Primary location

The incidence of oral cancer by primary location varies depending on the geographic region. Some reports have noted the tongue[6,8,10] as the primary site, while others note the lip[4,16] and buccal mucosa.[9,20] Tarvainen et al.[4] reported that the incidence of lip cancer in males had declined recently, and cited decreases in the smoking rate and in the number of outdoor workers as contributing factors. It was also reported that in regions where the incidence of cancer in the buccal mucosa was frequent, such as Karachi, Pakistan, the disease might be caused by the consumption of local foods such as betel quid, and that the incidence showed an increasing tendency in both males and females, especially among younger individuals.[9] In Japan, cancer of the tongue was reported to be the most frequent type of oral cancer in both the 1986 National Survey and the Nara Prefecture Survey. In the present survey, cancer of the tongue had the highest incidence ($n = 730$:40.2%).

Kawabe et al.[21] reported that 29 of 200 cases of oral cancer developed into multiple cancer, while Kawakami et al.[22] found that of 164 patients with cancer in the oral and maxillofacial region, 38 (23.2%) had multiple primary cancers and 12 had multiple cancers. Further, Saikawa and Ebihara[23] reported that, of 984 patients with oral cancer, 5 demonstrated simultaneous double cancers, with both the first and second tumors located in the oral cavity. In the 1986 National Survey, it was shown that there were 13 cases (0.9%) of multiple cancers in more than two locations. In the present survey, multiple cancers were found in 6 patients (0.3%), similar to the low incidence found in the 1986 National Survey. However, it is likely that metachronous multiple cancer was not included, as that survey period was only 1 year. In the present survey, of the patients with multiple cancers, 1 patient was aged 60 years and the others were older than 75. We consider it necessary to diagnose and treat elderly patients by taking multiple cancers into consideration.

Histopathological diagnosis

In the histopathological diagnosis of cancer in the oral and maxillofacial region, it has been frequently reported that squamous cell carcinoma was predominant, followed by salivary gland carcinomas and malignant lymphoma consisting mainly of adenoid cystic carcinomas.[1,5,7,8,16,24,25] In the present survey, squamous cell carcinoma was the major type, at 90.3%. For other types of cancer, salivary gland tumors originating in the minor salivary gland were frequently observed, though the incidence of salivary gland tumors was low in comparison to that in other reports. As for the reason for this low incidence, we considered that, in some of the cases with tumor location not noted in the registration form, the tumors were actually located in the salivary gland.

TNM classification

The number of cases by TNM classification and stage classification varies widely depending on the country, region, and institution. In Japan, cases classified as T2 and stage II are the most frequent.[1,5,26] However, the majority of patients in developing countries and regions are reported to be those with advanced cancer.[6,9,25,27] Carvalho et al.[28] compared the clinical features of patients with cancer in the oral and maxillofacial region between patients in developing and developed countries, and reported that the advanced type of cancer was more frequent in the former. Scott et al.[29] compared the incidence of early-stage and advanced-stage cancer in a United States population, and reported that early-stage cancer was significantly more frequent among females and married individuals, whereas advanced-stage cancer was more frequent in the nonwhite population. In the present study, no investigation was made regarding social factors such as occupation, home town, and marital status. In future investigations, to aid in earlier detection, we intend to take a wider variety of factors into consideration.

As for TN classification in the present survey, T2N0 cases were predominant, followed by T1N0 cases; thus, so-called early cancer, such as stage I and stage II, accounted for the majority. In comparison to the 1986 National Survey results, the proportion of T1 and T2 cases had increased slightly, with the proportion of T2 cases the greatest, while that of T3 and T4 cases had decreased. Similar to findings for tongue cancer cases reported in the Nara Prefecture Survey, the number of cases that were diagnosed at a relatively early stage tended to increase. However, the incidence of T3 and T4 cases together was greater than 30%, and when N and M factors were taken into account, advanced cancer cases accounted for nearly half of the cases in the present survey. Regarding N factor, in the present survey, the proportion of N0 and N2 cases had increased, whereas that of N1 and N3 had decreased as compared to the 1986 National Survey. We speculated that the proportion of patients who visit dentistry and oral surgery institutions directly or on a referral basis at an early stage might be increasing. As for the reason for the increase in the number of N2 cases, it is likely that cases that would have previously been diagnosed as N1 might now be correctly diagnosed as N2, according to progress in diagnostic imaging techniques such as computed tomography (CT) scanning.

According to T classification by tumor location, early-stage cases were predominant among patients with tongue cancer in the present survey, a finding which was also seen in the Nara Prefecture Survey. Further, early-stage cancer tended to be observed frequently in the lip and oral floor, whereas advanced-stage cancer tended to be more frequent in patients with cancer of the maxillary sinus and jawbone. It was considered that this higher frequency of advanced-stage cancer might have resulted from difficulty in detecting subjective and objective signs in these locations.

Calhoun et al.[30] studied distant metastasis of squamous cell carcinoma in the head and neck in 727 patients; 83 patients (11.4%) had distant metastasis during their clinical course. In these cases, 18.1% demonstrated distant metastasis at the first consultation. In the 1986 National Survey results, M1 accounted for 22 cases (1.6%), while M1 cases were slightly fewer in the present survey, at 17 cases (1.0%). In the present survey, not all of the distant metastases could be found at the time of the first consultation. We considered that distant metastasis would be observed in a greater number of patients during the treatment course. As the presence of distant metastasis strongly affects treatment and prognosis, it is considered necessary to improve diagnostic accuracy by the use of positron emission tomography (PET).

Nonepithelial tumors

In the Nara Prefecture Survey, malignant nonepithelial tumors accounted for about 10% of head and neck cancers. Malignant lymphoma was the predominant nonepithelial tumor, with the cervical lymph node and Waldeyer's ring being the most frequent locations. Although it has been reported that the incidence of malignant head and neck lymphoma is gradually increasing,[31] the incidence was extremely low in the present survey, at 8 cases (0.4%), in comparison to 61 cases (4.0%) reported in the 1986 National Survey. It was considered that malignant head and neck lymphoma was likely to have been excluded in the present survey, as malignant tumors were not itemized in the ICD-O code of the registration form (for initial registration). Thus, it is necessary to give extra consideration to the terms used for registration.

Howell et al.[16] reported the incidence of malignant melanoma as 0.1%. In the 1986 National Survey, 16 cases (1.1%) were reported, and Okamoto et al.[24] reported malignant tumors of the head and neck in 6 cases (0.3%). In the present study, there were 13 cases (incidence of 0.7%). The prognosis of malignant melanoma is extremely poor and its progress is rapid.[32] Although the incidence in the present survey was low, malignant melanoma characteristics must be taken into consideration during daily clinical practice at departments of dentistry and oral surgery.

As for so-called sarcomas, Yamaguchi et al.[33] studied 32 cases and reported that the incidence of osteosarcoma was highest, at 9 cases. In the present survey, osteosarcoma was reported in only a single case. Nonepithelial tumors vary in their histologic features and very few cases have been reported as compared to reports of carcinoma. We consider it necessary to continue our nationwide survey, and also to investigate the diagnosis, treatment, and prognosis of sarcomas.

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References

1. Uchida Y (1988) Statistical and epidemic studies of oral cancers diagnosed and treated by oral surgeons in Japan. Jpn J Dent Sci 7:16–26 (in Japanese)

2. Japan Society for Head and Neck Cancer (2001) General rules for clinical studies on head and neck cancer, 3rd edn. Kanehara, Tokyo, pp 22–28 (in Japanese)
3. Franceschi S, Bidoli E, Herrero R, et al. (2000) Comparison of cancers of the oral cavity and pharynx worldwide: etiological clues. Oral Oncol 36:106–115
4. Tarvainen L, Suuronen R, Lindqvist C, et al. (2004) Is the incidence of oral and pharyngeal cancer increasing in Finland? An epidemiological study of 17 383 cases in 1953–1999. Oral Dis 10:167–172
5. Miyahara H, Kitamura H, Sugimura M, et al. (2001) Malignant head and neck tumors in Nara prefecture. Jpn J Cancer Clin 47:333–339 (in Japanese)
6. Iamaroon A, Pattanaporn K, Pongsiriwet S, et al. (2004) Analysis of 587 cases of oral squamous cell carcinoma in northern Thailand with a focus on young people. Int J Oral Maxillofac Surg 33:84–88
7. Rawashdeh MA, Matalka I (2004) Malignant oral tumors in Jordanians, 1991–2001. A descriptive epidemiological study. Int J Oral Maxillofac Surg 33:183–188
8. Hogan LC, Hall GM, Chambers IG (2005) Oral cancer at a Tasmanian territory referral clinic, The Royal Hobart Hospital 1996–2002. Aust Dent J 50:31–36
9. Bhurgri Y (2005) Cancer of the oral cavity. Trends in Karachi South (1995–2002). Asian Pac J Cancer Prev 6:22–26
10. Ravi M, Mamta S, Kumar D, et al. (2003) Age specific incidence rate and pathological spectrum of oral cancer in Allahabad. Indian J Med Sci 57:400–404
11. Oshima A, Kuroish IT, Tajima K (eds) (2004) Cancer statistics in Japan. 2004. Shinohara, Tokyo, pp 202–217 (in Japanese)
12. Shiboski CH, Schmidt BL, Jordan RCK (2005) Tongue and tonsil carcinoma; increasing trends in the U.S. population ages 20–44 years. Cancer 103:1843–1849
13. Annertz K, Anderson H, Biorklund A, et al. (2002) Incidence and survival of squamous cell carcinoma of the tongue in Scandinavia, with special reference to young adults. Int J Cancer 101:95–99
14. Llewellyn CD, Johnson NW, Warnakulasuriya KAAS (2004) Risk factors for oral cancer in newly diagnosed patients aged 45 years and younger: a case-controlled study in Southern England. J Oral Pathol Med 33:525–532
15. Scully C (2002) Oral squamous cell carcinoma: from an hypothesis about a virus, to concern about possible sexual transmission. Oral Oncol 38:227–234
16. Howell RE, Wright BE, Dewar R (2003) Trends in the incidence of oral cancer in Nova Scotia from 1983 to 1997. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 95:205–212
17. Shimizu M (1989) Incidence and classification of oral cancer. In: Shimizu M, Kohama G (eds) Mundhohlen Karzinom Diagnose und Behandlung. Dental Diamond, Tokyo, pp 66–91 (in Japanese)
18. Health and Walfare Statics Association (2003) Journal of Health and Walfare Statics suppl 50(9). Health and Walfare Statics Association, Tokyo, pp 81–83 (in Japanese)
19. Kohama G (1989) Surgical treatment of carcinoma of the mandibular gingiva (including alveolar mucosa and retromolar region). In: Shimizu M, Kohama G (eds) Mundhohlen Karzinom Diagnose und Behandlung. Dental Diamond, Tokyo, pp 212–231 (in Japanese)
20. Wahid A, Ahmad S, Sajjad M (2005) Pattern of carcinoma of oral cavity reporting at dental department of Ayub Medical College. J Ayub Med Coll Abbottabad 17:65–66
21. Kawabe R, Omura S, Saito T, et al. (1999) Risk factors for multiple primary squamous cell carcinomas of the oral cavity. Jpn J Oral Maxillofac Surg 45:421–426 (in Japanese)
22. Kawakami M, Ikemura K (2004) Multiple primary malignant tumors in patients with squamous cell carcinoma of the oral cavity. Influence on the 5-year survival rate. J Jpn Stomatol Soc 53:9–13 (in Japanese)
23. Saikawa M, Ebihara S (2000) Multiple primary neoplasms in patients with squamous cell carcinoma of the oral cavity, mesopharynx, and hypopharynx. Stomato-pharyngol 12:349–360 (in Japanese)
24. Okamoto M, Takahashi H, Yao K, et al. (1999) Clinical trend of head and neck malignancy: a statistical analysis of 26-year experience at the Kitazato University. Oto-Rhino-Laryngology, Tokyo 42:474–482 (in Japanese)
25. Otoh EC, Johnson NW, Danfillo IS, et al. (2004) Primary head and neck cancers in North Eastern Nigeria. West Afr J Med 23: 305–313
26. Aoki S, Kawabe R, Hirota M, et al. (2003) Ten-year clinicostatistical study of oral squamous cell carcinoma. Yokohama Med J. 54:539–546 (in Japanese)
27. Busquets JM, Garcia HA, Pinedo JT, et al. (2003) Clinicopathological characteristics of head and neck squamous cell carcinoma in Puerto Ricans. P R Health Sci J 22:259–264
28. Carvalho AL, Singh B, Spiro RH, et al. (2004) Cancer of the oral cavity: a comparison between institutions in a developing and a developed nation. Head Neck 26:31–38
29. Scott SE, Grunfeld EA, McGurk M (2005) The idiosyncratic relationship between diagnostic delay and stage of oral squamous cell carcinoma. Oral Oncol 41:396–403
30. Calhoun KH, Fulmer P, Weiss R, et al. (1994) Distant metastases from head and neck squamous cell carcinomas. Laryngoscope 104:1199–1205
31. Yoshino K (2004) Trends of head and neck cancer – is it on the increase or decrease? 1. Epidemiology of head and neck cancer. Jibi Innkoka, Tokeibu Geka (Otolaryngology – Head and Neck Surgery) 76:345–350 (in Japanese)
32. Tanaka N, Mimura M, Ogi K, et al. (2004) Primary malignant melanoma of the oral cavity: assessment of outcome from the clinical records of 35 patients. Int J Oral Maxillofac Surg 33: 761–765
33. Yamaguchi S, Nagasawa H, Suzuki T, et al. (2004) Sarcomas of the oral and maxillofacial region: a review of 32 cases in 25 years. Clin Oral Investig 8:52–55