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The impact factors on 5-year survival rate in patients operated with oral cancer

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Abstract (J Korean Assoc Oral Maxillofac Surg 2013;39:207-216)

Objectives: The purpose of this study is to analyze clinical impact factors on the survival rate, and to acquire basic clinical data for the diagnosis of oral cancer, for a determination of the treatment plan with long-term survival in oral cancer patients.

Materials and Methods: Through a retrospective review of the medical records, the factors for long-term survival rate were analyzed. Thirty-seven patients, among patient database with oral cancer treated in the Department of Oral and Maxillofacial Surgery at Pusan National University Hospital within a period from March 1998 to March 2008, were selected within the study criteria and were followed-up for more than 5 years. The analyzed factors were gender, age, drinking, smoking, primary tumor site, type of cancer, TNM stage, recurrence of affected region, and metastasis of cervical lymph node. The 5-year survival rate on the impact factors was calculated statistically using the Kaplan-Meier method.

Results: By classification of clinical TNM at the 1st visit, there were 11 (29.7%) cases for stage I, 11 (29.7%) cases for stage II, 3 (8.1%) cases for stage III, and 12 (32.5%) cases for stage IV. The 5-year survival rate of total oral cancer patients after the operation were 75.7%, pathological TNM stage related 5-year survival rate were as follows: stage I 90.0%, stage II 81.8%, stage III 100% and stage IV 45.5%; in which the survival rate difference by each stage was significantly observed. The recurrence of cervical lymph node was the significant impact factor for the survival rate, because only 30.0% the survival rate in recurrent cases existed. During the follow-up, there were 15 (40.5%) patients with confirmed recurrence, and the 5-year survival rate of these patients was decreased as 46.7%.

Conclusion: The classification of clinical and pathological TNM stage, local recurrence after surgery, and metastasis of cervical lymph node after surgery were analyzed as the 3 most significant factors.

Key words: Oral cancer, Survival rate, Neoplasm metastasis, Recurrence, TNM classification

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I. Introduction

Considering an aging society with increased life expectancy, the percentage of people with cancer is increasing, and 5% of all tumors are occurring in the head and neck region; half of that 5% affect the oral cavity. Since 2000s, about 615,000 cases of oral cancer have been reported, 300,000 of which are known to be oral squamous cell carcinoma[1]. According to domestic research, about 2,800 patients--or approximately 1.6% of the total cancer patients--are diagnosed with malignant tumors in the oral and maxillofacial region annually[2].

Despite the development of diagnostic screening equipment, operation techniques, and postoperative care, there are a high number of patients manifesting advanced-stage oral cancer as well as high mortality. Because of this unfortunate situation, which persists until now, there have been continuous studies and reports on the deciding factors that would improve the survival rate of oral cancer patients. Among the factors to be considered are age, gender, stage at diagnosis, primary site and histopathologic classification, etc.[3-6]. Such basic research data are necessary, especially for patients who can still be cured. Note, however, that there is shortage of epi-

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demiology research done domestically for 5 years' follow-up study related to the factors impacting the patient's survival rate.

In this study, by analyzing the clinically important factors related to the long-term survival of oral cancer patients and assessing these factors, the resulting basic data will be helpful in developing diagnosis and treatment plans for oral cancer patients.

II. Materials and Methods

1. Patients

This study dealt with patients diagnosed with oral cancer and subjected to radical resection of lesion at the Department of Oral and Maxillofacial Surgery, Pusan National University Hospital between March 1998 and March 2008. The inclusion criteria were as follows:

1) Patient confirmed to have oral cancer through biopsy.

2) Patient who did not have metastasis at the first diagnosis.

3) Patient who did not receive any treatment for the primary tumor site in other hospitals.

4) Patient with no history of malignant tumors on any other part.

5) Patients operated by the same surgical team with similar treatment protocol.

6) Patient identified to be in a state of survival after diagnosis for 5 years.

The patients were interviewed, and their medical records were analyzed. Patients with no more follow-up visits after 5 years were contacted to confirm their survival by calling; when their survival was confirmed, additional clinical and radiological examinations were performed to determine the factors impacting the long-term survival rate.

During the observation period, the treatment strategy of our department could be changed for others depending on the general condition of the patient. Note, however,that chemotherapy prior to operation had been done for 2 cycles routinely, followed by radical wide excision and neck dissection as necessary. Likewise, chemotherapy and radiation therapy may be needed depending on the histopathologic results. (Table 1) Through the analysis of these records, we tried to review the treatment outcome and evaluate the detailed problems of all oral cancer patients. In addition, through long-term follow-up, analysis of the factors impacting the 5-year survival rate of oral cancer patients was performed.

2. Methods

The final 37 patients were analyzed by gender, age, degree of alcohol drinking, smoking status, primary site, type of carcinoma, histopathologic grade, stage, neck dissection, combination therapy, recurrence, and cervical lymph node metastasis; we then analyzed how these factors impacted the patient's 5-year survival rate for correlation.

The TNM stage was classified according to the TNM classification for the lip and oral cavity of the American Joint Committee on Cancer Guide (7th edition). Each of the impacting factors was compared and reviewed by making individual tables for each factor. Considering the status of patients from the point when follow-up is over, survival was assumed when the patient had been alive for 5 years from diagnosis; if the follow-up was paused, or the patient was discharged due to other reasons, such was treated as censored data.

As a retrospective clinical study, this study was approved by the Pusan National University Dental Hospital Institutional Review Board (IRB No. PNUDH-2013-007).

III. Results

1. Overview of clinical data

This report summarized the overall clinical data, medical history, clinical examination, and image examination of 37

Table 1. Protocol for the treatment of head and neck malignancy in the Department of Oral and Maxillofacial Surgery at Pusan National University Hospital

TNM stage	Surgery	ND	Chemotherapy		Radiation		Others (immune)
			Pre-op.	Post-op.	Pre-op.	Post-op.	
Stage I	+	S+<-	+<-	-	-	+<-	-
Stage II	+	S+	+	+<-	-	+<-	-
Stage III	+	C+	+	+>-	-	+/-	+/-
Stage IV	+	C+	+	+	+/-	+>-	+/-

(ND: neck dissection, op.: operation, S: selective, C: comprehensive, +: treatment, -: no treatment, >, <: treatment priority, +/-: treatment status according to disease severity)

Dong-Ho Geun et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

Table 2. Summary of patients

No.	Sex	Age (yr)	Smoking, pack/day (yr)	Alcohol	Site	Biopsy	cTNM	Neck operation	Histodifferentiation	Neoadjuvant	Postadjuvant	pTNM	cN	pN	Recur	N-meta	D-meta
1	M	51	-	-	T	SCC	Stage I	-	Moderate	-	RTx.	Stage II	N_0	-	N	N	N
2	M	26	-	Habitual	T	SCC	Stage I	-	Well	-	CTx.	Stage I	N_0	-	Y	N	N
3	M	53	1	Habitual	BM	SCC	Stage IV	SOHND	Well	CTx.	CTx.	Stage IV	N_{2b}	N_{2b}	Y	Y	N
4	M	60	0.5	Social	FOM	SCC	Stage III	SOHND	Well	CTx.	CTx.	Stage IV	N_1	N_{2b}	N	Y	N
5	M	57	1 (28)	Social	HP	SCC	Stage I	-	Well	CTx.	-	Stage I	N_0	-	Y	N	N
6	M	51	-	Social	LA	SCC	Stage IV	SOHND	Moderate	CTx.	-	Stage III	N_{2b}	N_0	N	N	N
7	M	55	1 (30)	Social	T	SCC	Stage III	SOHND	Moderate	CTx.	CTx.	Stage III	N_1	N_1	N	N	N
8	F	42	-	-	T	SCC	Stage I	SOHND	Well	CTx.	CTx.	Stage I	N_0	N_0	N	N	N
9	M	32	-	-	LA	SCC	Stage III	SOHND	Well	CTx.	CTx.	Stage III	N_1	N_0	N	N	N
10	M	55	0.5	Habitual	HP	ACC	Stage II	-	-	CTx.	RTx.	Stage II	N_0	-	N	N	N
11	M	61	-	Social	FOM	SCC	Stage II	SOHND	Well	CTx.	-	Stage II	N_0	N_0	N	N	N
12	M	59	1 (20)	-	LA	SCC	Stage IV	RND	Moderate	CTx.	-	Stage IV	N_{2b}	N_{2b}	Y	Y	Y
13	F	74	-	-	LA	SCC	Stage IV	mRND	Well	CTx.	RTx.	Stage IV	N_{2b}	N_0	N	N	N
14	F	63	-	-	HP	Melanoma	Stage I	-	-	-	-	Stage I	N_0	-	N	N	N
15	M	70	-	Social	UA	SCC	Stage IV	RND	Moderate	CTx.	CTx., RTx.	Stage IV	N_3	N_3	Y	Y	Y
16	M	62	-	-	BM	SCC	Stage II	-	Well	-	-	Stage II	N_0	-	Y	Y	N
17	F	61	-	Social	FOM	BCC	Stage IV	mRND	-	-	RTx.	Stage IV	N_{2b}	N_{2b}	Y	N	Y
18	F	48	-	-	T	SCC	Stage I	SOHND	Well	CTx.	CTx.	Stage I	N_0	N_0	N	N	N
19	F	68	-	-	LA	SCC	Stage IV	RND, SOHND	Well	CTx.	-	Stage IV	N_{2c}	N_{2c}	N	N	N
20	M	52	-	Habitual	BM	ACC	Stage I	-	-	-	-	Stage I	N_0	-	N	N	N
21	F	77	-	-	LA	SCC	Stage II	SOHND	Well	-	-	Stage II	N_0	N_0	N	N	N
22	M	72	1 (50)	-	LA	SCC	Stage IV	RND	Poorly	-	-	Stage IV	N_{2b}	N_{2b}	N	Y	N
23	F	40	-	-	T	SCC	Stage I	-	Poorly	-	CTx.	Stage I	N_0	-	N	Y	N
24	F	76	-	-	T	SCC	Stage II	SOHND	Moderate	-	-	Stage II	N_0	N_0	N	N	N
25	M	45	1 (15)	Social	UA	SCC	Stage IV	-	Well	-	CCRT	Stage IV	N_0	-	N	N	N
26	F	81	-	-	LA	SCC	Stage II	-	Poorly	-	-	Stage I	N_0	-	N	N	N
27	M	57	-	Social	LA	SCC	Stage I	-	Well	-	CCRT	Stage I	N_0	-	N	N	N
28	M	70	0.5	Social	HP	Melanoma	Stage II	-	-	-	CTx.	Stage II	N_0	-	N	N	Y
29	M	50	0.5	Social	PG	ACC	Stage I	-	-	-	RTx.	Stage I	N_0	-	N	N	N
30	M	34	-	-	LA	Osteo-sarcoma	Stage II	RND	-	-	CTx.	Stage II	N_0	N_0	Y	N	N
31	F	43	0.5	-	UA	SCC	Stage IV	RND	Poorly	CTx.	CTx., RTx.	Stage IV	N_1	N_1	Y	Y	Y
32	M	62	1	Habitual	FOM	SCC	Stage IV	RND	Moderate	-	CTx.	Stage IV	N_{2b}	N_1	Y	Y	Y
33	F	72	-	-	T	SCC	Stage II	-	Well	-	CTx.	Stage II	N_0	-	N	Y	Y
34	M	45	-	Social	LA	SCC	Stage II	SOHND	Well	CTx.	-	Stage II	N_0	N_0	N	N	N
35	M	43	0.5	-	T	SCC	Stage IV	RND	Well	CTx.	CTx.	Stage II	N_1	N_0	N	N	N
36	F	59	-	-	T	SCC	Stage I	-	Well	CTx.	CTx.	Stage I	N_0	N_0	Y	N	N
37	M	28	-	-	T	SCC	Stage II	mRND	Well	CTx.	CTx.	Stage III	N_0	N_1	N	N	N

(cTNM: clinical TNM, pTNM: pathologic TNM, cN: clinical N stage, pN: pathologic N stage, Recur: recurrence, N-meta: neck nodal metastasis, D-meta: distant metastasis, M: male, F: female, T: tongue, BM: buccal mucosa, FOM: floor of the mouth, HP: hard palate, LA: lower alveolus, UA: upper alveolus, PG: parotid gland, SCC: squamous cell carcinoma, ACC: adenocystic carcinoma, BCC: basal cell carcinoma, SOHND: supraomohyoid neck dissection, RND: radical neck dissection, mRND: modified RND, CTx.: chemotherapy, RTx.: radiotherapy, CCRT: concurrent chemo-radiotherapy, N: No, Y: Yes)

Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

patients. For smoking, we recorded the average number of cigarettes smoked each day; for drinking, drinking more than 0.5 bottles (Korean vodka, Soju) per day was considered habitual. In the study, 13 patients were heavy smokers, and 17 were habitual drinkers.

All patients included in this study received wide excision on the primary site and neck dissection. The types of neck dissection conducted included supraomohyoid neck dissection, modified radical neck dissection (mRND), and RND.

In this article, 19 cases were for pre-operation chemotherapy, 17, for post-operation chemotherapy, and 7, for radiation therapy after operation in those cases, including 2 patients who sequentially received both therapies as well as 2 patients who received concurrent chemo-radiotherapy.(Table 2)

1) Gender and age

Out of the 37 patients, 24 (64.8%) were male and 13 (35.2%) were female. Patients under 40 years accounted for 29.7%, and those over 50 years constituted 70.3%. The average age was 55 years, ranging from 26 to 81.(Table 3)

2) Primary tumor sites

Areas most affected by oral cancer were the tongue and alveolar ridge of the lower jaw with 11 (29.7%) cases each, followed by alveolar ridge of the upper jaw and palate with 7 (18.9%) cases each, floor of the mouth (FOM) with 4 (10.9%) cases, and buccal mucosa/retromolar trigone with 3 (8.1%) cases.(Table 4)

3) Histological types of cancer

For the distribution of tumor histology, there were 30 (81.1%) cases of squamous cell carcinoma (SCC), 3 (8.1%) cases of adenocystic carcinoma, 1 (2.7%) case of basal cell carcinoma, 2 (5.4%) cases of melanoma, and 1 (2.7%) case of osteosarcoma.(Table 5)

4) TNM stage

In the clinical TNM (cTNM) classification, 11 (29.7%) cases were found to belong to stage I, 11 (29.7%), to stage II, 3 (8.1%), to stage III, and 12 (32.5%), to stage IV. By analyzing the results of post-operative histopathologic specimen, in the pathologic TNM (pTNM) classification, 11 (29.7%) cases were for stage I, 11 (29.7%), for stage II, 4 (10.8%), for stage III, and 11 (29.8%), for stage IV.(Table 6)

5) Factors associated with cervical metastasis

The percentage of mutual concordance between cTNM and pTNM was 83.8%. Cases diagnosed as cervical lymph node metastasis (pN+) numbered 11 (29.7%), with 10 (27.1%) cases of recurrence of cervical lymph node metastasis within

Table 3. Gender and age

Age (yr)	No. of patient		Total
	Male	Female	
20-29	2	0	2 (5.4)
30-39	2	0	2 (5.4)
40-49	3	4	7 (18.9)
50-59	10	1	11 (29.8)
60-69	4	3	7 (18.9)
70-79	3	4	7 (18.9)
80-89	0	1	1 (2.7)
Total	24 (64.8)	13 (35.2)	37 (100)

Values are presented as number or number (%).

Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

Table 4. Primary tumor sites

Primary site	n (%)
Tongue	11 (29.7)
Lower alveolus	11 (29.7)
Upper alveolus & palate	7 (18.9)
Floor of the mouth	4 (10.9)
Buccal mucosa & retromolar trigone	3 (8.1)
Etc. (parotid gland)	1 (2.7)
Total	37 (100)

Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

Table 5. Histopathologic diagnosis

Type	n (%)
SCC	30 (81.1)
ACC	3 (8.1)
BCC	1 (2.7)
Melanoma	2 (5.4)
Osteosarcoma	1 (2.7)
Total	37 (100)

(SCC: squamous cell carcinoma, ACC: adenocystic carcinoma, BCC: basal cell carcinoma)

Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

Table 6. Clinical and pathological TNM classification in patients

TNM stage	Clinical TNM	Pathologic TNM
Stage I	11 (29.7)	11 (29.7)
Stage II	11 (29.7)	11 (29.7)
Stage III	3 (8.1)	4 (10.8)
Stage IV	12 (32.5)	11 (29.8)
Total	37 (100)	37 (100)

Values are presented as number (%).

Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

5 years. Cervical lymph node diagnosed as clinically negative (cN0) was positive in the pathological result (pN+) in patients who showed occult nodal metastasis (3 cases). There were 15 (40.5%) oral cancer patients who experienced recurrence in the primary site or cervical lymph node metastasis, 11 of whom underwent resection or neck dissection on the recurrence area or affected cervical lesion. The other 7 (18.9%) patients were found to experience metastasis in the lung and base of the skull during 5 years.(Tables 2, 6)

6) Histological differentiation of squamous cell carcinoma

The SCC patients were classified according to the histological differentiation of specimen. Out of all the patients, those diagnosed with SCC through biopsy (n=30) were analyzed by categories of prevalence and survival rate according to the differentiation. There were 19 (63.4%) cases for the well-differentiated type, 7 (23.3%) cases for the moderately differentiated type, and 4 (13.3%) cases for the poorly differentiated type according to histological differentiation.(Table 7)

7) Primary tumor resection, neck dissection, and reconstruction methods

All analyzed patients primarily underwent wide excision of the primary site. Of all patients who seemingly had no metastasis (cN0), including the patients who seem to have cervical lymph node metastasis clinically, T2-4 and T1 tongue cancer patients had elective or therapeutic neck dissection performed. Various reconstruction methods were used in the reconstruction of the defect site. The reconstruction methods used in this study include cervical flap, pectoralis major myocutaneous flap (7 cases), radial forearm free flap (8 cases), fibular free flap (2 cases), latissimus dorsi flap (1 case), and deep circumflex iliac artery flap (1 case).

2. Analysis of survival rate

1) 5-year survival rate

The survival rate of 37 oral cancer patients was 75.7%.(Fig. 1)

Table 7. Histopathologic differentiation distribution of SCC

Type	n (%)	Survival rate (%)
Well-differentiated	19 (63.4)	94.7
Moderate-differentiated	7 (23.3)	57.1
Poorly-differentiated	4 (13.3)	25.0
Total	30 (100)	

(SCC: squamous cell carcinoma)

Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

2) Survival rate according to stage

The survival rate according to pTNM is shown in Fig. 2 (stage I: 90.0%; stage II: 81.8%; stage III: 100.0%; stage IV: 45.5%).

3) Survival rate according to histological differentiation

The survival rate according to histological differentiation among patients diagnosed with SCC was 94.7% for the well-differentiated type, 57.1% for the moderately differentiated type, and 25.0% for the poorly differentiated type.(Fig. 3)

4) Survival rate according to the primary site recurrence, cervical lymph node metastasis

After operation, there were 15 (40.5%) patients who experienced recurrence in the primary site or cervical lymph node metastasis. Out of these 15 patients, 7 (46.7%) of them were

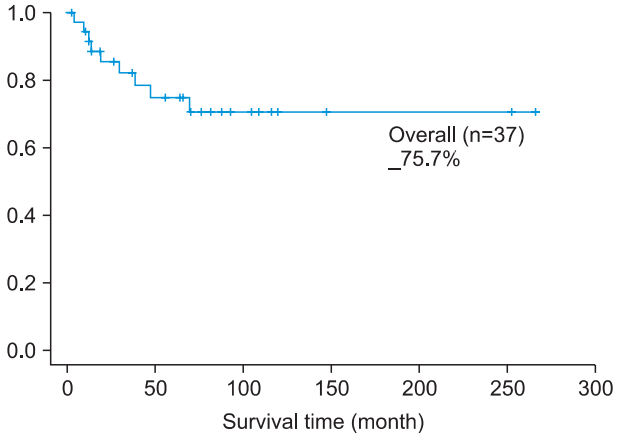

Fig. 1. Overall survival rate.

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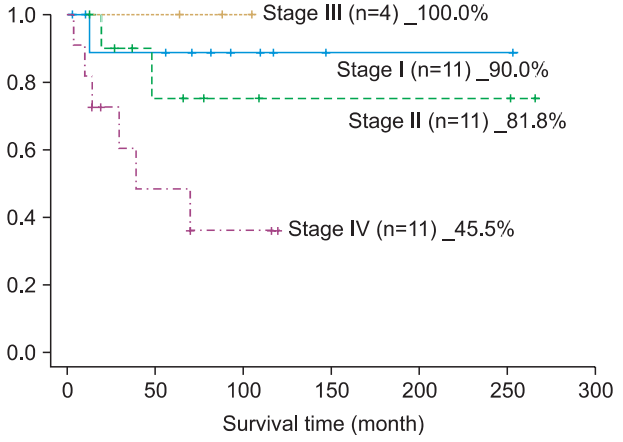

Fig. 2. Stage-specific survival rate (Log rank test: *P*=0.027).

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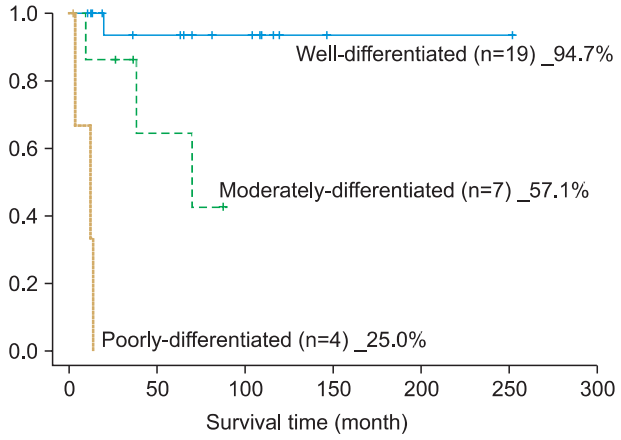

Fig. 3. Histopathologic differentiation-specific survival rate in squamous cell carcinoma (Log rank test: *P*=0.000).
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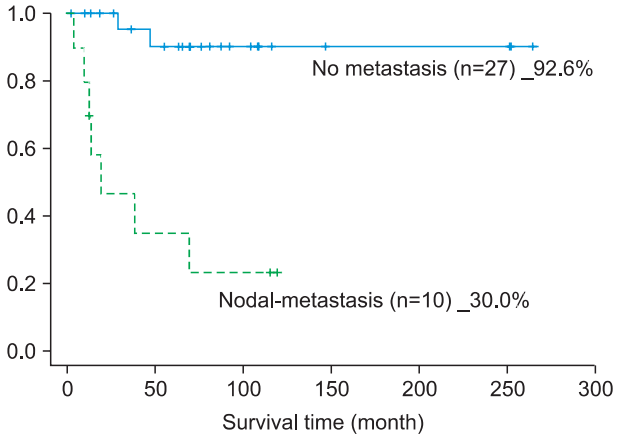

Fig. 5. Neck nodal metastasis-specific survival rate (Log rank test: *P*=0.000).
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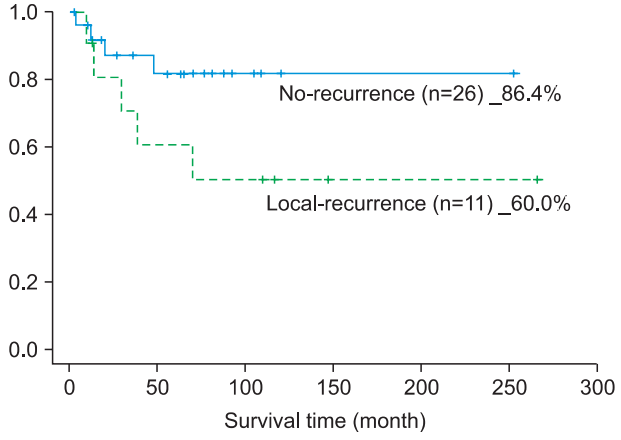

Fig. 4. Recurrence-specific survival rate (Log rank test: *P*=0.097).
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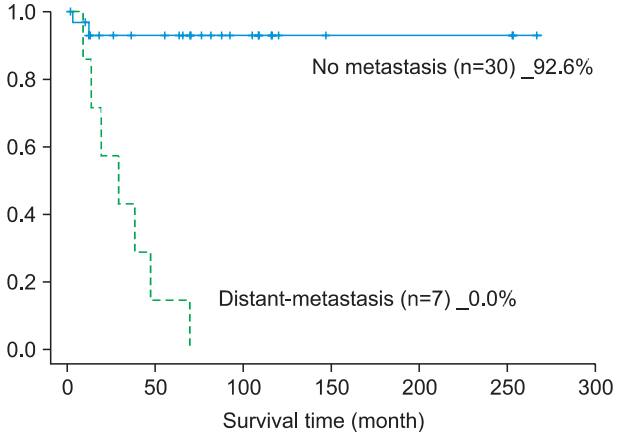

Fig. 6. Distant metastasis-specific survival graphs (Log rank test: *P*=0.000).
Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

alive. Regarding these factors as independent variables on the 5-year survival rate, the recurrence rate for the primary tumor and cervical lymph node metastasis after surgery was 60.0% and 30.0%, respectively. These results showed significant lower percentage compared with the non-affected group's 86.4% and 92.6%, respectively.(Figs. 4, 5)

Among the 10 patients who had recurrence of cervical lymph node, only 3 of them survived for 5 years.

5) Logistic regression test between factors and survival

In this study, out of the patients experiencing metastasis to the other organs, no patients survived over 5 years.(Fig. 6) Currently, there are no radical treatments established for metastatic lesions derived from oral cancer, and the treatment choices of these terminally ill patients are clinical trials or palliative therapy[7]. Based on this, we statistically analyzed the other factors investigated in this study and used them as a scale to figure out how each of the factors affects the decreasing survival rate. We found a significant relationship with post-operative cervical lymph node metastasis.(Table 8)

IV. Discussion

Out of the 37 oral cancer patients included in this study, 23 (62.2%) were male and 14 (37.8%) were female. This represents a 1.6 : 1 ratio, showing a comparable result with the United States male oral cancer percentage ratio of 60.2% and Funk et al.[8] and Kim et al.[9] reported percentage ratio of 65.7% males and 34.3% females. In this study, however, gen-

Table 8. Results of binary logistic regression analysis on the correlation between the factors and survival

	Gender	Age	pTNM	Recurrence	Neck metastasis	Distant metastasis
P-value	0.501	0.179	0.033	0.051	0.000*	0.000*

(pTNM: pathologic TNM)
*Significant value (coefficient) $P<0.01$.
Dong-Ho Geum et al: The impact factors on 5-year survival rate in patients operated with oral cancer. J Korean Assoc Oral Maxillofac Surg 2013

der was not related to the 5-year survival rate.

In this study, 13 (35.1%) patients were heavy smokers and 17 (46.0%) were habitual drinkers, showing lower percentages compared to the previous reports (57-65%)[9-14]. This seemed to be due to the bias of patients in the interview at the time of hospitalization; hence the difficulty in revealing that smoking and alcohol may have significant effects on the survival rate in this report.

According to the research of Krolls and Hoffman[15], oral cancer frequently strikes those in their 40s-70s. According to Kim et al.'s report[9], males in their 70s and females in their 60s were affected mostly by oral cancer. In this study, out of all the age distributions of oral cancer patients, patients in their 50s (11 patients in their 50s with the average)--with average age of 55.5 years (±13.9)--were most affected. There were 11 (29.7%) patients under 40 years and 26 (70.3%) patients over 50 years, resulting in a higher number of older patients. Note, however, that 26- and 28-year-old patients with tongue cancer were observed in these cases as well. It is the form of oral cancer that can affect even a healthier and younger age group as well. Out of the 37 patients, the oldest patient was an 81-year-old male who did not show any recurrence of the primary site or cervical lymph node metastasis after 1 year since operation but expired due to general weakness and respiratory disease; thus, this case was processed as censored data. There were no significant changes in the survival rate of oral cancer patients by age group; as factors that can have an effect on the 5-year survival rate among the elderly and patients who had systemic diseases, however, limitations in choosing the treatment method due to general condition, age, patient-related complications, and deaths caused by associated diseases may be considered[16].

Based on the histopathologic examination of specimen after operation, SCC accounted for more than 80% of the results, showing similar ratio of generally known oral tumors[17]. In this study, the survival rate of patients with cancer occurring on the FOM was lowest at 50.0% for 5 years. This seems to be due to the difficulty in terms of surgical approach and cervical lymph metastasis tendency on both sides; considering these facts, the primary lesion's location can be regarded as a perilous factor that can affect survival.

According to Shah and Patel[17], oral cancer's TNM patient stage ratio was 37% (stage I), 36% (stage II), 18% (stage III), and 9% (stage IV). In domestic research, Kim et al.[9] reported that, out of 180 oral cancer patients, 31 (17.2%) cases belonged to stage I, 24 (13%), to stage II, 14 (7.8%), to stage III, and 111 (61.7%), to stage IV. The difference in prevalence between types of stage was deemed attributable to the patients' residence, financial status, and cultural differences; hence the need for additional epidemiological research on the patient's economic activity or education level and oral health policy by location. In inferring the reason for the high prevalence level of patients in early stages (stage I, II) and terminal stage (stage IV) in this study, patients diagnosed with oral cancer in the earlier stages were mostly transferred to our hospital because such can be found out by chance when they visit the local clinic due to different chief complaints, and others, by visiting the hospital doctors after suffering from edema and pain since the cancer has already progressed.

The concordance of cTNM and pTNM was 83.8%, relating to the reliability of the magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography-CT (PET-CT) examinations before the operation to evaluate the primary site, cervical metastasis, and distant metastasis. In this study, PET-CT examination was mainly used for the evaluation of cervical lymph node metastasis or follow-up check before operation.

According to the reports of Goshen et al.[18], PET-CT examination has 88% accuracy, 100% sensitivity, and 77% specificity. When it came to negative predictive value from patients who showed metastasis, it was found to be 100%. In Nahmias et al.'s research[19], 192 out of 1,678 lymph nodes had histopathologic metastasis, with sensitivity and specificity to N0 reported to be 79% and 82%, respectively; those to N+ were 95% and 25%, respectively. Thus, sensitivity and specificity for cervical metastasis were concluded to be 48% and 99%, respectively. In addition, PET-CT ensures patients' comfort when setting the irradiation site for radiation therapy[20].

In this study, there were 3 patients who showed signs of

occult neck nodal metastasis, with 4 patients testing positive (cN+) in the clinical examination but pathologically negative (pN0) for cervical lymph node. Moreover, the sensitivity of the cervical lymph node examination before operation was 76.9%, and its specificity was 83.3%. From cN0, the potential diagnostic methods for cervical lymph node metastasis (palpation, X-ray, fine needle aspiration cytology) are affected by the number of lymph nodes removed and histological techniques for the examination of lymph nodes[21]. Therefore, when we perform surgery and treatment for the oral cancer patient, we should consider PET-CT or other examinations, cognizant of the need for neck dissection for occult lymph node metastasis as one of the complications of surgery. Likewise, clinical follow-up and careful review of the clinical findings and diagnostic examination at an appropriate time after the operation are very important.

Cho and Kim[22] reported a 54% 5-year survival rate among oral cancer patients during the period 1991 to 1996. Kim et al.[9] found the 5-year survival rate of oral cancer patients from 1999 to 2006 to be 57.7%. From the report of Lee et al.[23], however, the 5-year survival rate of oral cancer patients was 63.2%. This study took the records of patients who underwent operations during the period 1998 to 2008, and the 5-year survival rate of these patients was 75.7%, which was considerably higher than that of previous research studies.

Comparing the ratio of patients in stage IV, Lee et al.[23] reported 57.1%, Cho and Kim[22], 61.3%, and Kim et al.[9], 61.7%. Note, however, that the ratio of this study was lower (35.2%). The etiology seems to be based on the other research studies for cases in stage IV and who did not undergo surgery but received palliative therapy. The same cannot be said for this study, though.

Our unusual stage III result (100%) for this study can be attributed to the small number of patients in stage III. The small number of individuals in the stage III results can also be seen in other research studies[9,22-24]. To guess the reason, the situation wherein the primary carcinoma (T3) does not cause cervical lymph node metastasis and the situation wherein carcinoma less than 4cm (T1, T2) causes cervical lymph node metastasis are unlikely to occur. Moreover, if there were T1 and T2 patients who did not show clinical cervical metastasis clinically, they can have cervical lymph node metastasis; if patients in other stages actually belonged to stage III, then such can explain the low ratio of stage III.

According to the 5-year survival rate in the case of cervical lymph node metastasis, in this study, a significant difference of 62.6% was noted between the two groups; in the research by Koo et al.[25], similar results of 43% and 79% were reported. Note, however, that the treatment of clinically negative cervical lymph node is still controversial. Nonetheless, it is important to consider the potential for cervical metastasis before proceeding with surgery. According to Zbären et al.'s study[26], 20% of patients with cervical lymph node metastasis--which is pN0 in the oral cancer and pathological examination--have potential for metastasis or recurrence. On the other hand, O'Brien et al.[27] stated that there may be a 30% possibility. Similarly, Keski-Säntti et al.[28] reported a low 5-year survival rate of 33% for patients confirmed to have cervical metastasis during observation and who underwent salvage surgery.

Thus, the 5-year survival rate of oral cancer patients with cervical lymph node metastasis is a very important factor in prognosis; bearing in mind the potential for cervical lymph node metastasis, and even if it is a case of cN0, planning ipsilateral or bilateral (tip of tongue, FOM, >T3, over the midline primary tumor) neck dissection must be considered[25,29-31].

In this study, there were 15 (40.5%) patients with primary tumor recurrence or cervical lymph node metastasis, 7 of whom survived the second operation. The 5-year survival rate in case of recurrence was 46.7%; looking at cervical lymph node metastasis cases separately, however, the 5-year survival rate was lower than 30%. After operation, if the recurring tumor grows deeper in the primary site or in the cervical region, it usually positions itself in a place that is difficult to excise; hence the difficulty of completing resection due to the surrounding anatomical structures. As a result, even with the salvage surgery option as mentioned previously, the survival rate is assumed to become even lower[25,28,29]. Moreover, cervical lymph node metastasis itself implies the possibility of distant metastasis, apparently causing the lower 5-year survival rate.

As found in this study, too, oral cancer has high possibility of recurrence, in which case the prognosis is poor; hence the importance of continuous follow-up. The follow-up conducted in this study was monthly for up to 6 months after the operation and once every 3 months from 6 months to 1 year after operation; from 1 year to 5 years, only when there was recall and if required by the patient was the PET-CT examination used to check closely for recurrence, cervical lymph node metastasis, and distant metastasis. According to the National Comprehensive Cancer Network guideline related to carcinoma of the head and neck, during follow-up, there is a need to consider the recurrence, risk of secondary primary tumor, treatment methods, and complications[30,32]. We need to examine carefully the clinical symptoms and findings of the

patient and, if necessary, perform radiology imaging examination. Likewise, the guideline suggests that CT, MRI, and PET-CT examinations--which use radiology and contrast--be performed each year after operation for high-risk patients (1) with two or more lymph node metastasis, (2) wherein the affected size of a single lymph node is larger than 3 cm, (3) with extravasation spread of nodal lesion, and (4) with history of previous recurrence[30].

An advantage of this study is that it controlled variables by selecting oral cancer patients who received treatment from the same surgical team from a single lab. For its limitations, however, only a small number of target group were considered for the epidemiological studies. In the future, there is a need to collect more patient data to determine the survival rate of each patient by treatment method and analyze how, given the same primary site and cervical lymph node metastasis status, the combined treatment method--such as chemotherapy and radiotherapy performed with primary tumor resection--affects the patient's survival rate.

V. Conclusion

A total of 37 oral cancer patients were analyzed based on gender, age, drinking status, smoking status, primary site, type of carcinoma, TNM stage, neck dissection, combination treatment and affected area, and cervical lymph node metastasis, including how these factors impacted the 5-year survival rate of each of the patients.

1. The 5-year survival rate of oral cancer patients was 75.68%; the pathological TNM stage-related, 5-year survival rate was as follows: 90.0% in stage I, 81.8% in stage II, 100% in stage III, and 45.5% in stage IV. The observed difference in survival rate by stage was statistically significant.

2. In the case of cervical lymph node metastasis after operation, the 5-year survival rate was 30%; the patients who did not have such had a 92.6% 5-year survival rate, showing significant difference as well as the greatest impact on the survival rate.

3. Based on the histopathologic examination, the well-differentiated type accounted for the largest portion of SCC's histological differentiation classification. As for the 5-year survival rate, the well-differentiated type recorded 94.7%, moderately differentiated type, 57.1%, and poorly differentiated type, 25.0%; thus showing a large difference in the survival rate depending on the differentiation classification.

4. Two factors--postoperative cervical lymph node metastasis and distant metastasis--had positive moderate coefficient correlation.

5. During the follow-up period, there were 15 (40.5%) patients with confirmed recurrence; the 5-year survival rate of these patients was 46.7%, which was lower than the total survival rate.

In summary, the factor wielding the biggest impact on long-term survival rate after operation was founded to be cervical lymph node metastasis after operation. Clinical and pathological TNM stage and local recurrence were found to be another strong factor impacting the 5-year survival rate. Therefore, we can confirm the primary tumor and pathological findings of cervical lymph node after operation and potentially improve the long-term survival rate of the patients through close follow-up observation to detect any and all postoperative findings such as cervical metastasis.

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