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Original Article

Effects of educational status and the living environment on the prognosis of head and neck squamous cell carcinoma

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ABSTRACT

Introduction and purpose: Educational status and the living environment are closely related to the survival rates of patients with head and neck cancer. In this study we evaluate the effects of educational status and the living environment on the survival of patients with head and neck cancer.
Materials and methods: Patients with head and neck tumors that show squamous cell histological properties were included in the study. Cases had been followed up in Dicle University Medical Faculty Medical Oncology clinic between January 2006 and June 2013. Data was collected retrospectively from the medical records of the patients. Classical parameters, which are considered to affect the prognosis, such as age, gender, stage, tumor localization and performance status, were investigated, in addition to educational status and the living environment.
Results: The study comprised 171 cases. The rate of metastatic disease was determined to be higher in illiterate patients, when compared to ones with at least an elementary school or higher education (12.7% and 8.1%, respectively; $p = 0.012$). Similarly, patients living in rural areas showed higher rates of metastatic disease, when compared to those living in cities (16.3% and 8.0%, respectively; $p = 0.146$). It was determined that the educational status (median overall survival in the cases with elementary school or higher education 21.5 months; in cases that cannot read or write, it is 10.3 months; $p = 0.001$) and the environment being lived (median overall survival in cases living in cities 17.6 months; in cases living in rural areas it is 9.0 months; $p = 0.014$) affect survival in the patients with head and neck cancer. In the multivariate analysis; age (>60 vs < 60, OR: 1.94, 95% CI 1.19–3.17, $p = 0.008$), educational status (cases that cannot read or write vs elementary school or higher, OR: 1.64, 95% CI: 1.03–2.62, $p = 0.037$) and stage (early stage vs local advanced stage, OR: 3.07, 95% CI: 1.58–5.94, $p = 0.01$, early stage vs late stage, OR: 3.49, 95% CI: 1.52–8.03, $p = 0.003$) were determined to be independent prognostic factors.
Discussion: In addition to the classical prognostic factors, educational status was also determined to be an independent prognostic factor in the squamous cell head and neck cancers, and this fact was especially related with late diagnosis. The prognostic effect of living in rural area was determined by univariate analysis; however it was not determined to be an independent prognostic factor in the multivariate analysis.

1. Introduction

Head and neck cancers are among the most frequently observed cancer types in the world.[1] Distinct worldwide geographical differences exist in the anatomical distributions and incidences of head and neck cancers. Regional differences in the use of alcohol and tobacco, which contributes to the development of 80% of the head and neck cancers, are considered to be responsible for this fact. As a result of decreased tobacco use in the developed countries, incidences of larynx and oral cavity cancers in particular, decrease[2]; on the contrary, incidences of oropharyngeal squamous cell carcinoma have been determined to increase. This increase is explained by the increased frequency of exposure to high-risk subtypes of HPV.[2,3] Though variations exist in the incidences of

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head and neck cancers in developed countries, they are still observed in the highest rates in developing countries.

It is known that cancer survival can be affected by socioeconomic status.[4,5] Various studies have been performed to investigate the effects of socioeconomic conditions (occupation, education, living environment) on the risk and survival rates of head and neck cancer.[6–8] These studies indicated that cases with low socioeconomic level carry higher risks for head and neck cancers, when compared to those with higher socioeconomic level. However when other risk factors like alcohol and tobacco are considered, the importance of this finding is observed to decrease and a strong relation with other risk factors for head and neck cancers continue to exist.[6] In a study by Olsen et al of 9683 patients with head and neck cancers, the relation of socioeconomic level with the survival of head and neck cancer was evaluated. Rates of mortality risk at diagnosis for each subtype of head and neck cancer were determined to be higher in those patients with low socioeconomic level (low income and low educational status) and in those living in rural areas.[7] However, the complex relation of head and neck cancers with socioeconomic conditions has not yet been fully clarified. The aim of the present study is to determine the effects of educational status and the living environment on the survival of patients with head and neck squamous cell cancer.

2. Materials and methods

In our study, the medical records of patients with squamous cell head and neck tumors were investigated retrospectively; the patients had been followed up in Dicle University Medical Faculty Medical Oncology clinic between January 2006 and June 2013. Demographic, clinical and histopathological data of the patients were obtained from their medical and hospital records. Furthermore, parameters considered to affect the prognosis, such as age, gender, stage, tumor localization and performance status were investigated, in addition to educational status and the environment being lived.

The patients were separated to two groups, according to where they lived: ones from city centers, and ones not from the cities. The patients that are not from the city centers (from villages and small villages) were considered to be from the rural areas. These two groups, ie those from the rural areas and the others from the centers (city and town centers), were evaluated with regard to their survival rates. The patients were separated to two further groups, by assessing their educational and literacy levels; the ones that cannot read or write, and the others with at least an elementary education, or higher (elementary education, high school, university). These groups were also evaluated with regard to survival rates.

By considering the stages (according to the TNM staging system), cases were categorized according to local and local advanced stages (one group), and metastatic stages (the other group); the survival rates of these groups were also evaluated. The performance status of the patients was evaluated during application, using the Eastern Cooperative Oncology Group (ECOG) scoring system. One group involved the cases with ECOG 0 and 1, and the other group included the cases with ECOG 2,3 and 4; the survival rates of these two groups were also investigated.

Statistical analysis was performed using the SPSS 18.0 software program. Univariate analysis was applied to evaluate links to age, gender, ECOG performance status, stage (local, local advanced/metastatic), tumor localization (nasopharynx/nonnasopharynx) and mortality risk. These variables were also evaluated by multivariate analysis. Frequency tables were illustrated, and data analyzed using the Chi-square test and the Mann–Whitney U test. The Kaplan Meyer method was used in evaluating survival rates. A p value < 0.05 was accepted as statistically significant.

3. Results

The study included 171 patients, most of who were males (n = 149, 87.1%). The median age was 60 (13–93) years. The most frequent localization was found to be larynx (n = 107, 63%). 68% (n = 116) of the patients were of ECOG performance status 0–1, and 32% (n = 55) were of ECOG performance status 2 or higher. 10.2% (n = 17) of the patients were of late (metastatic) stage at diagnosis, 28.1% (n = 48) were of local stage, and 61.7% (n = 106) were of local advanced stage. 77% (n = 132) were from city centers, and 23% (n = 39) were from rural areas. 46% (n = 79) of the patients included ones that cannot read or write, and 54% (n = 92) included cases with at least elementary education. Rate of metastatic disease was determined to be higher in the patients that cannot read or write, when compared to ones with at least elementary or higher education (12.7% and 8.1%, respectively; p = 0.012). Similarly, patients living in rural areas showed higher rates of metastatic disease, when compared to those living in cities (16.3% and 8.0%, respectively; p = 0.146) (Table 1). Stage distributions of the patients from rural areas, when diagnosed at their application, were as follows: late stage 16.3% (n = 6), local advanced stage 65.1% (n = 25), and localized stage 18.6% (n = 8). For the patients from city centers, diagnostic distributions at their application were as follows: late stage 8% (n = 11), local advanced stage 60% (n = 79), and local stage 32% (n = 42). Diagnostic distributions of the cases who could not read and write, during their application were as follows: late stage 12.7% (n = 9), local advanced stage 67.6% (n = 54), and localized stage 19.7% (n = 16); these distributions for the patients that took at least elementary education, were as follows: late stage 8.1% (n = 7), stage 57.6% (n = 53), and local stage 34.3% (n = 32). Patients from rural areas, and those who have low educational status, attend the hospital at later stages of the disease, and this fact negatively affected their survival.

Factors that were determined to affect prognosis by using univariate analysis: age (for median OS <60 21.5 months; for >60 months 9.2; p = 0.003), ECOG performance status (median OS for PS 0–1 16.1 months, for PS > 1 10.1 months, p = 0.002), stage (median OS in local stage 29.8 months, in local late stage 12.3 months, in late stage 9 months, p = 0.004), and tumor localization (median OS in nasopharynx Ca 29.8 months, in non-nasopharynx Ca 11.3 months, p = 0.015). Gender was not found to affect prognosis (median OS in women 46.2, in men 14.3, p = 0.237) (Table 2). Educational status (median OS in cases with at least elementary education 21.5 months, in cases that cannot read or write 10.3 months, p = 0.001), and the living environment (median OS in cases from cities 17.6 months, in cases from rural areas 9.0 months, p = 0.014) were also found to affect survival rates in patients with head and neck cancer (Figs. 1 and 2). Cases with low educational levels and those living in rural areas were found to have poorer survival expectations.

In the multivariate analysis; age (>60 vs < 60, OR: 1,94, 95% CI 1.19–3.17, p = 0.008), educational status (cases that cannot read or write vs elementary school or higher, OR: 1.64, 95% CI: 1.03–2.62, p = 0.037) and stage (early stage vs local advanced stage, OR: 3.07, 95% CI: 1.58–5.94, p = 0.01, early stage vs late stage, OR: 3.49, 95% CI: 1.52–8.03, p = 0.003) were determined to be independent prognostic factors (Table 3).

4. Discussion

Distinct socioeconomic inequality is known to exist in head and neck cancer risk. This inequality cannot be solely explained by the

Table 1
Ratio of metastatic disease

	Ratio of localized disease (%)	Ratio of local advanced disease (%)	Ratio of metastatic disease (%)
Educational status:			
Reads and writes (≥elementary)	34,3	57,6	8.1%
Illiterate	19,7	67,6	12.7% (p:0.012)
Living environment:			
City	32	60	%8.0
Rural	18,6	65,1	%16.3 (p:0.146)

Table 2
Parameters that affect overall survival

	Median OS (month)	p value
Age		
<60	21,5	0.003
>60	9,2	
Gender		
men	14,3	0.237
women	46,2	
ECOG PS		
0-1	16,1	0.002
>1	10,1	
Stage		
Local	29,8	
Local advanced	12,3	0.004
Metastatic	9	
Localization		
Nasopharynx	29,8	0.015
Non-nasopharynx	11,3	
Educational status		
İlliterate	10,3	0.001
Reads/writes (>=elementary)	21,5	
Living environment		
City	17,6	0.014
Rural	9	

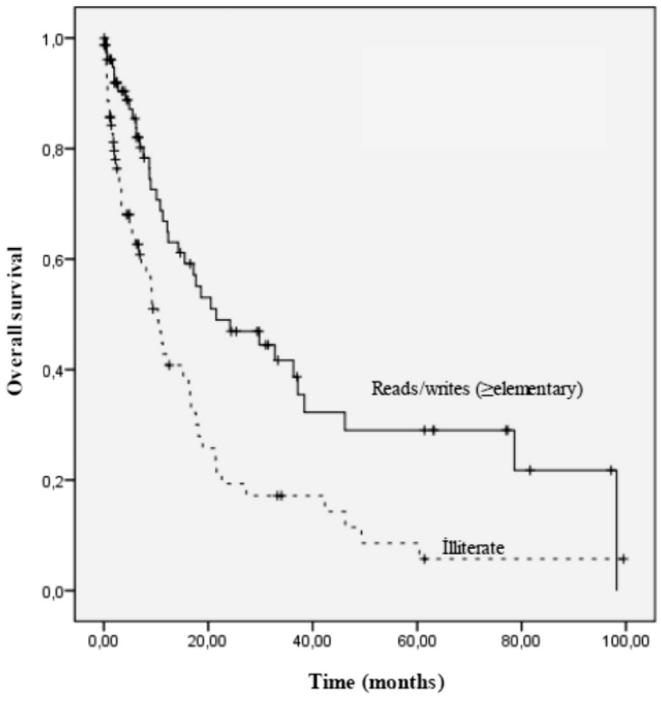

Fig. 1. Educational status and survival rates (21.5 months vs10.3 months, p < 0.01).

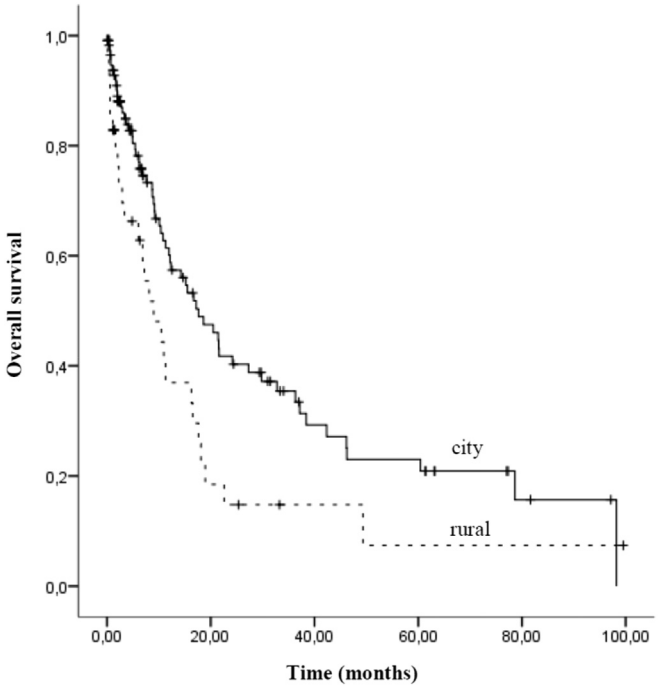

Fig. 2. Living environment and survival rates (17.6 months vs 9.0 months, p:0.014).

Table 3
Multivariate analysis

	OR	95% CI	p value
Age	1,94	1.19–3.17	0.008
Educational status	1,64	1.03–2.62	0.037
Stage			
Early vs local advanced	3,07	1.58–5.94	0,01
Early vs metastasis	3,49	1.52–8.03	0.003
Localization	1,7	0.85–3.40	0.173
ECOG PS	1,35	0.84–2.17	0.214
Gender	1,1	0.46–2.62	0.832
Living area	0,99	0.57–1.70	0.975

known behavioral risk factors (tobacco, alcohol consumption, dietetic factors).

Various studies indicate different results in the relation between socioeconomic level and smoking. Smoking frequency is reported to be higher in populations with low socioeconomic level in the USA, but similar findings have not been shown in European studies.[9,10]

Socioeconomic status in studies has generally been determined by occupational measurements and income level. Educational status is accepted to be an indirect indicator of income level. In our study, educational status and the environment being lived have

been considered to be indicators of the patients' socioeconomic levels.

Socioeconomic conditions (occupation, education, home environment, income level) have been indicated as affecting both the risk of cancer and survival rates in patients with head and neck cancer.[6–8] Previous studies determined the independent effects of social factors when behavioral risk factors (tobacco, alcohol use) were all taken into account.[11–13] In other studies, the significance of social effects was shown to disappear when behavioral risk factors were considered.[6,14]

In the recent wide-spectrum studies, socioeconomic risk factors were evaluated with behavioral risk factors, and the increased risk related with socioeconomic risk factors could not be explained by behavioral risk factors.[13,15]

The positive relation of head and neck cancer with the poor socioeconomic conditions could not be indicated in a study performed in Italy.[16] Similarly in two previous studies; increased risk for the late stage head and neck cancer could not be determined in the patients living in environments that indicate low income level.[17,18]

In the recent years, in addition to head and neck cancers, socioeconomic differences were shown to affect survival rates in various malignities like nonhodgkin lymphoma and breast, lung, rectum and cervix cancers.[19–23] In a study by Chu et al performed in Asia and Pacific islands (n = 4711), low socioeconomic level was determined to be related to markedly poorer disease-specific and overall survival rates in all subtypes of head and neck cancers OS HR: 1.3 (95% CI 1.16–1.45). It remained as an important prognostic factor, even after being evaluated with other patient and tumor properties, by the multivariate analysis.[24]

In our study, in addition to the classical prognostic factors, educational status was indicated to be an independent prognostic factor in the head and neck cancers. Living in the rural area was shown to exert a prognostic effect in the univariate analysis, but it was not determined to be an independent prognostic factor in the multivariate analysis.

Similar to the previous studies; though number of patients was limited, our study confirmed that head and neck cancers have poorer survivals in the patients with low educational status and in those living in the rural areas. Patients with low educational levels and those from the rural areas present at the hospital in the later stages of the disease, and this is considered to result in poorer survival results. However metastatic disease and educational level were determined to be independent prognostic factors in our study, and this finding resulted in our suggesting that area being lived and educational level may affect prognosis via other mechanisms. Various mechanisms have been suggested to explain the relations between low socioeconomic level, and head and neck cancer; one of these is the effect of education on the behavioral risk factors (tobacco and alcohol use). In another study, effects of low social class were explained by occupational exposure to toxic substances.[25] Additionally socioeconomic levels are considered to be related to the availability of health services, dental services and dental care, perception of symptom importance and stress factors. Biological pathways between the socioeconomic effects and cancer development have not yet been completely clarified. Currently, hypotheses related to the effects of biological aging (short telomere) due to poor socioeconomic conditions have also been suggested.[26,27] Further detailed studies are needed to explain this relation.

In recent years, especially the frequency of oropharynx cancer, has shown variability. This variation is related to the increase in frequency of head and neck cancers caused by HPV. Survival results of HPV-related cancers are better when compared with those of HPV-unrelated cancers.[2,3] It is not yet known if the relation between socioeconomic level and survival is affected from HPV positivity in the head and neck cancers, and particularly oropharynx cancers. In a study by James et al, variabilities developing over time were investigated in the relation between head and neck cancer survival rates and socioeconomic level; the effect of socioeconomic level on survival rates was proven in this study. The magnitude of difference, between the lowest and highest socioeconomic levels, increased with time when oropharynx cancers were considered; however this was not statistically significant. They also suggested that this study might indirectly prove the more frequent HPV positivity existence[8] in those subjects with of a high socioeconomic level.

Limitations of our study are as follows: low number of patients and lack of evaluations related with the other risk factors like tobacco and alcohol use, and HPV positivity that are effective on the survival of head and neck cancer patients.

In conclusion, it may be considered that poor survival rates are expected in those patients with head and neck cancer who are from low socioeconomic groups. Being from a higher socioeconomic level may lead to earlier diagnosis and thus to the determination of the disease at an earlier stage. This study indicates the importance of public health training and providing the easy-availability of health services in the patients from a lower educational level and socioeconomic status. Various supportive applications starting from diagnosis are also needed to improve the survival results in the patients of head and neck cancer, with low socioeconomic status.

In order to improve public health, risk factors for diseases and factors affecting survival have to be evaluated in detail, in order that more effective interventions can be produced. By decreasing the prevalence of preventable risk factors in head and neck cancers, it would be possible to protect from these cancers, and survivals will also be positively affected.

Conflict of interest

There is no conflict of interest.

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