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The impact of socioeconomic factors on quality of life and functional impairment in patients treated for oropharyngeal carcinoma

Uticaj socioekonomskih faktora na kvalitet života i funkcionalno oštećenje bolesnika lečenih od orofaringealnog karcinoma

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Abstract

Backround/Aim. Considering the distinct increase in the incidence of oropharyngeal cancer over oral cavity cancers and changing epidemiology with human papilloma virus (HPV) infection emerging as an important risk factor, there is a need to establish better treatment choices in specific groups of patients with oropharyngeal cancer. The aim of this study was to assess the quality of life (QOL) and functional performance and the impact of different demographical data, stage of disease, and treatment type on these parameters in patients with oropharyngeal cancer with successfully achieved locoregional control a year after the treatment. **Methods.** Study included 87 patients who underwent QOL and functional impairment assessment 12 to 14 months after finished oncological treatment with the following questionnaires: the European Organization for Research and Treatment of Cancer Quality-of Life-Questionnaire-C30 (EORTC QLQ-C30), European Organization for Research and Treatment of Cancer Quality of- Life Questionnaire-Head and Neck 35 (EORTC QLQ-H&N35) and The Karnofsky Performance Scale (KPS). **Results.** Specific groups of patients had significantly different post-treatment QOL scores. The factors associated with the worse QOL scores were female gender, not being in a partnership, level of education and HPV status. **Conclusion.** Clinicians should consider socioeconomic factors and HPV status in planning the recovery after treatment of patients with oropharyngeal carcinoma. Gender, education level and employment are the variables that form a certain risk profiles associated with the lower QOL.

Key words:
papillomaviridae; socioeconomic factors; pharyngeal neoplasms; quality of life; treatment outcome.

Apstrakt

Uvod/Cilj. Incidencija orofaringealnih karcinoma se povećavala tokom poslednje decenije, a epidemiologija promenila sa pojavom humanog papiloma virusa (HPV) kao bitnog faktora rizika od ovih karcinoma. Potrebno je ustanoviti bolje terapeutske izbore za specifične grupe bolesnika koji se leče od orofaringealnog karcinoma. Cilj ove studije bio je da se procene kvalitet života i funkcionalne performanse, kao i uticaj različitih demografskih faktora, stadijuma bolesti i tipa terapija na te parametre kod bolesnika sa orofaringealnim karcinomom kod kojih je postignuta uspešna lokoregionalna kontrola, godinu dana posle sprovedene terapije. **Metode.** Studija je uključila 87 bolesnika koji su odgovorili na upitnike o kvalitetu života i funkcionalnim performansama: *European Organization for Research and Treatment of Cancer Quality-of Life-Questionnaire*-C30 – EORTC QLQ-C30), *European Organization for Research and Treatment of Cancer Quality of- Life Questionnaire-Head and Neck* 35 (EORTC QLQ-H&N35) i *Karnofsky Performance Scale* (KPS), 12 do 14 meseci posle završenog onkološkog tretmana. **Rezultati.** Specifične grupe bolesnika značajno su se razlikovale u skorovima na upitnicima za kvalitet života posle lečenja. Faktori koji su bili povezani sa slabijim rezultatima su bili ženski pol, život bez partnera, nivo obrazovanja, zaposlenost i HPV status. **Zaključak.** Kliničari bi trebali da uzmu u obzir socioekonomske faktore i HPV status u planiranju postoperativnog

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oporavka kod bolesnika lečenih od orofaringealnog karcinoma. Pol bolesnika, nivo obrazovanja i zaposlenost su faktori koji nose određen nivo rizika koji je povezan sa nižim nivoom kvaliteta života kod ovih bolesnika.

Ključne reči:
papillomaviridae; socijalno-ekonomski faktori; farinks neoplazme; kvalitet života; lečenje, ishod.

Introduction

It is estimated that oropharyngeal cancer makes up to 3% of all newly diagnosed carcinomas, with majority of cases occurring in developing countries [1, 2]. Although common risk factors are preventable and most of the cases are easily diagnosed by a standard oral exam, due to a huge lack of awareness, disease is usually detected in the advance stages [3].

In the past decade, patient's quality of life (QOL) and functioning after the treatment became an important additional tool for assessing the treatment outcome of oral cavity and oropharyngeal cancer [4]. A number of recent studies assessed quality of life in patients with both entities combined, but it should be considered that oropharynx and oral cavity are two different anatomical sites, each with its own specific anatomy and functions. Oropharyngeal region includes following sub-sites: base of tongue, tonsil, and oropharynx, opposing to oral cavity region which includes lip, oral tongue, floor of mouth and gums, palate or other sections of the mouth. This distinctions became more important in light of the new patterns noticed in etiology and incidence trends. First, there is a distinct increase in the incidence of oropharyngeal cancer with the decrease in the incidence of oral cavity cancers [5, 6]. In the United States, tonsillar cancer showed to be most frequent diagnosed oropharyngeal cancer. Second most frequent diagnosed site was base of the tongue. Both sites showed increasing incidence during a period from 2000 to 2010 comparing to the trends for other anatomic sites of the oral cavity and oropharynx.[6] Secondly, a shift in age of diagnosis has happened, making 6th and 7th decade of life high risk period for oropharyngeal cancer compared to oral cavity cancer [6, 7]. Thirdly, epidemiology of oropharyngeal cancer changed, with risk factors like smoking and alcohol replaced with human papilloma virus (HPV) infection. Oropharyngeal cancer caused by HPV occurs in different population to that commonly associated with head and neck cancers, with significantly better prognosis than the HPV negative cancers [8]. These trends are forcing us to further narrow our focus on better treatment choices for oropharyngeal cancer and post-treatment quality of life in specific groups of patients. The patients with oropharyngeal cancer confront the substantial QOL issues after successful cancer management [9]. Depending on the sociodemographic characteristics, choice of the treatment and stage of the disease, going back to regular diet, performing usual everyday tasks and professional duties require a significant effort in these patients.

The aim of this study was to assess the impact of different demographic data, HPV status, stage of disease, and treatment type on QOL and functional performance in the patients with oropharyngeal cancer with successfully achieved locoregional control a year after the treatment.

Methods

This cross-sectional study included 87 patients diagnosed with carcinoma of the oropharynx in the Clinic for Otorhinolaryngology and Maxillofacial Surgery of the Clinical Centre of Serbia in Belgrade in one-year period (from January 2009 to January 2010). This study was approved by the Institutional Ethics Committee (440/IX-3/09), and all patients signed informed consent form prior to their inclusion into the study. The patients were treated in the period from undergoing necessary diagnostic procedures (clinical exam, tumor biopsy and histopathology verification, radiological diagnostics). The modality of treatment for every patient was decided on the Oncological Board (consisting of radiotherapist, head and neck surgeons, oncologist and histopathologist). The HPV positivity was confirmed with HPV16 *in situ* hybridisation and the positive p16 immunohistochemical staining of the tissue samples [10, 11]. The surgical therapy involved resection of the tumor (local resection or hemiglossectomy) with some form of neck dissection in case of cervical lymphadenopathy. Radiotherapy consisted of external radiotherapy with a total dose of 60 to 70 Gy in 30–35 fractions for 6–7 weeks. The patients received chemotherapy concurrently with radiotherapy; three courses of cisplatin (CDDP) intravenously, on 1st, 4th and 7th week of radiotherapy. In the patients who were disease-free, QOL and functional impairment assessment was conducted 12 to 14 months after finished oncological treatment. The patients with recurrent disease were excluded from the study.

For assessing the QOL, two types of questionnaires were used: the European Organization for Research and Treatment of Cancer Quality - of Life - Questionnaire-C30 (EORTC QLQ-C30) and the European Organization for Research and Treatment of Cancer Quality of- Life Questionnaire - Head and Neck 35 (EORTC QLQ-H&N35) [12]. The questionnaires were translated into Serbian. The EORTC QLQ-C30 is a cancer-specific questionnaire, divided into 5 functioning scales (physical, role, emotional, cognitive and social), 3 symptom scales (fatigue, nausea/emesis and pain), 6 single items (dyspnea, insomnia, appetite loss, constipation, diarrhea and financial impact) and one global health and QOL scale. The scores were given as a 0–100 scale. The higher scores for the global QOL scale and for a functional scale indicated a higher level of functioning, and the higher scores for a symptom scale or a single-item scale indicated more severe symptoms and worse QOL. The EORTC-H&N35 is a site-specific questionnaire designed to assess QOL in the head and neck cancer patients made of 7 symptom scales (pain, swallowing, sense, speech, social eating, social contact and sexuality) and 11 single items associated with the location, symptoms of the disease and treatment

(teeth problems, mouth opening, dry mouth, sticky saliva, coughing, feeling ill, painkiller intake, nutritional supplements, feeding tube, weight loss and weight gain). The highest scores represented the highest level of symptoms. The scores were interpreted into the scoring guidelines established by the EORTC manuals. The Karnofsky Performance Scale (KPS) Index was used to classify the patients' functional impairment. The scores range from 0 to 100; the higher score, the patient is more able to carry out daily activities [13]. The differences in EORTC QLQ-C30, EORTC QLQ-H&N35 and KPS Index scores were compared depending on age, gender, place of living, level of education, living arrangement/marital status, employment position, HPV status, the American Joint Committee on Cancer (AJCC) stage of the disease and treatment choices of the patients.

Statistical analysis was performed using the SPSS v20 (SPSS Inc., Chicago, IL). To determine differences between examined groups of patients, depending on the investigated parameters, the *t*-test and ANOVA were used. The Pearson's correlation test was used to determine the correlation between EORTC QLQ-C30, EORTC QLQ-H&N35 and KPS Index scores and other parameters. The *P*-value less than 0.05 was considered statistically significant.

Results

The study included 87 patients (69 males and 18 females) of an average age of 59.6, years. The patients were diagnosed and treated for oropharyngeal carcinoma between October 2009 and October 2011 in the Clinic for Otorhinolaryngology and Maxillofacial Surgery of the Clinical Centre of Serbia in Belgrade. Basic demographic characteristics of the patients were given in Table 1. The patients are predominantly male, living in urban areas, in partnerships or married, laborers with secondary high school education. Out of all patients included in the study, 39 (44.8%) were HPV positive. Most of the patients (47.1%) were diagnosed with stage IV oropharyngeal cancer. The treatment modalities differed; most of the patients were treated operatively with postoperative radiotherapy (31%) or with radio/chemotherapy (31%).

The mean value and standard deviation of EORTC QLQ-C30, EORTC QLQ-H&N35 and KPS Index scores are given in Tables 2 and 3. Regarding EORTC QLQ-C30 and KPS Index, women had significantly worse physical, emotional, cognitive and social functioning, and felt more fatigued, had more frequent dyspnea, insomnia, and appetite loss than men (Table 4). Emotional and cognitive functioning was significantly worse in the patients who were single ($p = 0.048$ and $p = 0.046$ respectively), than in those living in marriage or partnership. There was significantly higher global quality of life in the patients with higher education (faculty and PhD) ($p = 0.039$). The unemployed suffer more from insomnia that the patients working in managerial positions ($p = 0.046$). The HPV positive patients were complaining significantly less of pain and dyspnea comparing to the HPV negative patients ($p = 0.024$ and $p = 0.043$ respectively). Physical functioning was significantly better in the patients in the stage I of the disease comparing to the patients in the stages III and IV of the disease ($p = 0.2$ and $p = 0.008$ respectively). Social functioning was significantly better in the patients who underwent surgery comparing to the patients who underwent radio/chemotherapy and the patients who underwent surgery with radio/chemotherapy ($p = 0.033$ and $p = 0.025$ respectively). In the EORTC QLQ-H&N35 questionnaire, the women had significantly higher scores than the men regarding senses, contact, sexuality and felling ill ($p < 0.05$). The patients living in a partnership or in marriage had significantly less complaints about their sexual life ($p = 0.008$), felt less ill ($p = 0.049$) and used less painkillers ($p = 0.006$) than the patients who were single. The patients with the stage I carcinoma complained about the senses problem significantly less than the patients with the stages III and IV of carcinomas ($p = 0.221$ and $p = 0.25$ respectively). The patients treated with radio/chemotherapy felt significantly more pain than those treated operatively with postoperative radio/chemotherapy ($p = 0.017$).

Table 1

Demographic characteristics of the patients included in the study

Characteristics	n (%)
Gender	
male	69 (79.3)
female	18 (20.7)
Place of living	
urban	64 (73.5)
rural	23 (26.5)
Living arrangement	
single	27 (31)
in a partnership/married	60 (69)
Level of education	
no formal education/elementary school	33 (37.9)
secondary/high school	40 (45.9)
faculty/PHD	14 (16.2)
Employment position	
laborer	48 (55.2)
technical worker (sales, production,	10 (11.5)
maintenance, operation)	5 (5.7)
administrative worker	15 (17.2)
manager (education, health, business)	9 (10.4)
unemployed	
HPV status	
positive	39 (44.8)
negative	48 (55.2)
AJCC Stage	
I	11 (12.7)
II	9 (10.3)
III	26 (29.9)
IV	41 (47.1)
Treatment modality	
OP	9 (10.3)
RT	8 (9.2)
OP + RT	27 (31)
RT + CT,	27 (31)
OP + RT + CT	16 (18.5)

OP – operation; RT – radiotherapy; CT – chemotherapy; HPV – human papilloma virus; AJCC – American Joint Committee on Cancer.

Table 2

EORTC QLQ-C30 and KPS Index scores depending on the investigated parameters (all values are expressed as mean value ± standard deviation)

Characteristics	Global quality of life	Physical functioning	Role functioning	Emotional functioning	Cognitive functioning	Social functioning	Fatigue	Nausea	Pain	Dyspnea	Insomnia	Appetite loss	Constipation	Diarrhea	Financial difficulty	KPS Index
Gender																
male	59.8±22.9	80.4±17.7	75.8±29.9	77±22.7	84.8±21.7	83.6±25.5	22.9±23	5.8±13	26.3±24.9	11.6±21.5	20.8±30.8	14.5±27.1	7.7±20.7	6.2±20	33.8±39.8	80.4±10.5
female	56±31.7	68.1±24	65.7±35.4	52.3±35.2	65.7±27.1	67.6±32.1	45±28.9	12±12.5	27.8±29.1	29.6±34.1	50±36.6	35.2±38.7	22.2±37.9	5.6±17.1	44.4±37.9	79.4±5.4
Place of living																
urban	57.3±25.1	77.8±20.9	73.5±30.8	69.5±29.8	78.8±25.6	78.8±26.9	29.6±27.4	8.7±14.6	28.6±25.8	18.5±25.9	30.7±36.1	21.6±32.3	10.6±25.3	5.8±18.5	37.6±40.8	79.7±10.6
rural	64.4±24.7	76.9±16.6	71.9±33.5	78.8±19.9	85.6±19.4	82.6±28.1	21.7±21	3±6.6	21.9±26.4	6±22.1	16.7±26.7	12.1±26.3	12.1±28.2	7.6±22.8	33.3±37.1	81.4±6.4
Living arrangement																
single	52.5±28.7	74.3±17.4	66.7±38.9	62±32.8	72.2±28.1	75.3±33.1	34.6±28.1	8±12.5	29.6±23.7	14.8±26.7	35.8±40.2	25.9±33.7	13.6±31	8.6±23.7	46.9±38.4	78.9±13.1
in a partnership/married	61.9±22.6	79.4±20.5	76.9±26.8	76.4±23.7	84.7±21.1	82.5±24.6	24.2±24.2	6.7±13.4	25.3±26.7	15.6±24.9	22.8±30.4	15.6±29.1	9.4±23	5±17.2	31.1±39.2	80.8±7.6
Level of education (E)																
no formal E/elementary school	52.5±26.4	75.3±22.7	66.2±29.6	66.2±29.2	73.7±27	77.8±26.9	34±25	10.1±15.6	30.3±28.1	23.2±28.2	31.3±34.3	27.3±35.8	12.1±27.4	6.1±19.5	42.4±41.9	79.1±6.3
secondary/high school	59.6±24.1	77.2±18.3	75.8±34.4	73.9±27.2	83.3±21.7	81.2±30	24.7±27.66	6.7±12.4	26.2±24.1	13.3±24.8	26.7±35.6	15.8±29.2	13.3±28	6.7±21.6	37.5±40.1	79.5±11.7
faculty/PhD	72.6±18.3	85.7±13.8	85.7±20.5	79.8±23	90.5±19.3	83.3±22.6	19.8±19.6	1.2±4.4	19±24.3	2.4±8.9	16.7±28.5	7.1±14.2	0±0	4.8±12.1	16.7±25.31	85±8.5
Employment position																
laborer	53.6±25.5	77.2±18.9	70.1±31.7	72.4±26.7	79.9±23.8	81.9±28.3	27.3±27.5	9±15.3	26.7±25.7	17.4±26.6	25.7±35.2	20.1±32	14.6±27.4	7.6±20.9	36.8±40.8	79.6±10.9
technical worker	69.2±24.9	87.3±14.9	96.7±10.5	85.8±21.5	88.3±19.3	88.3±22.1	14.4±18.2	3.3±10.5	15±19.9	6.7±21.1	16.7±28.3	6.7±21.1	0±0	0±0	33.3±41.6	81±5.7
administrative worker	43.7±15.8	65± 16.7	79.2±31.5	45.8±25	79.2±15.9	70.8±28.4	47.2±16.7	8.3±9.6	45 8±21	16.7±19.2	41.7±31.9	41.7±31.9	25±50	0±0	50±43	75± 10
manager	72.2±17.7	84±14.8	82.2±23.9	80±22.2	91.1±18.7	82.2±22.2	20.7±19.2	1.1±4.3	22.2±26.5	2.2±8.6	15.5±27.8	6.7±13.8	0±0	11.1±27.2	20±27.6	84±9.1
unemployed	63.9±25.3	66.7±30	55.5±39.9	50±32	68.5±28.2	64.8±35.8	44.4±27.8	11.1±11.8	35.2±29.4	33.3±33.3	59.2±27.8	37±42.3	11.1±33.3	0±0	51.8±44.4	78.9±6
HPV status																
positive	68.5±29.4	79.2±14.6	74.2±27.5	73±25.7	83.8±25.4	83.5±27.9	39.9±28	14.8±14	37.8±25.1	29.6±21.5	20.7±32	33.6±25.1	18.7±27	5.3±20	38.3±35.8	80.6±15.5
negative	59±26,6	73.1±21	68.8±31.3	68.2±33.1	78.7±27.2	77.3±30.2	32±26.4	6±12.2	20.3±28.8	10.6±34.1	22±33.7	25.2±27.7	20.2±33.9	6.8±16.4	41.1±36	80±6.7
AJCC Stage																
I	55.8±23.6	82.5±16.4	73.7±33.7	80±22.2	82.5±24.1	85.4±24.2	45.6±24.2	15±18.3	40±21.1	30±29.2	46.7±32.2	30±36.7	13.3±28.1	3.3±10.5	20±32.2	78±9.2
II	68±21.2	81.7±15.4	78.5±28.4	72.2±28.2	84.7±22.5	80.5±27.2	31.7±37.6	11.9±12.6	35.7±32.5	33.3±38.5	38.1±40.5	38.1±48.8	14.3±37.8	4.8±12.6	52.4±37.8	80±5.8
III	66.7±30.4	71.4±36.8	71.4±30	54.8±41.9	73.3±26.3	66.7±33.3	21.7±22.8	4.9±9.2	22.9±25.9	8.3±20.2	25±37.1	6.9±13.8	6.9±24	8.3±24.6	43.1±38.7	80.8±6.5
IV	46.7±27.8	59.3±14.5	65±30.9	57.5±23	73.8±30.2	65±33.7	25±24.6	6.2±13.9	25.4±25.6	11.7±22.1	21.7±30.7	20±31.8	13.3±25.9	6.7±20.2	31.7±39.9	79.7±11.9
Treatment modality																
OP	65.6±20.4	82.1±15	81.2±20.1	84.9±17.3	87.5±15.5	90.6±14.9	42±29.3	14.8±13	35.2±22.7	33.3±23.6	40.7±27.8	22.2±28.9	11.1±33.3	3.7±11.1	22.2±37.3	81.1±9.3
RT	63.5±36.7	71.7±33.7	72.2±31.2	71.3±30.7	82.1±24.9	87±23.3	33.3±33.6	10.4±15.3	31.2±32.6	29.2±33	45.8±43.4	29.1±45.2	12.5±24.8	8.3±23.6	66.7±35.6	78.7±8.3
OP + RT	63.6±24.5	79.7±17.9	68.7±31.4	75±21.3	82.1±22.1	79±29.4	21±26.6	8±15.6	21±20.4	11.1±22.6	25.9±35	14.8±31.1	14.8±29.7	3.7±10.7	28.4±38.9	80.7±14.6
RT + CT,	52.8±20.1	78.3±18.3	78.4±32.3	57.4±27.8	70.4±25	66.7±35.6	30.9±23.7	3.7±8.4	35.2±28.6	13.6±26.6	25.9±33.7	23.4±28.9	9.9±24.1	12.3±29.4	35.8±41.2	79.2±6.1
OP + RT + CT	48.2±31.4	68.9±20.8	66.7±35.5	54.2±39.1	70.8±36.5	57.4±30.2	21.5±18.8	5.2±13.2	14.6±21.8	8.3±19.2	12.5±26.9	10.4±26.4	4.2±16.7	0±0	41.7±35.5	81.2±3.4

EORTC QLQ-C30 – European Organization for Research and Treatment of Cancer Quality -of Life-Questionnaire-C30; KPS – Karnofsky Performance Scale; OP – operation; RT – radiotherapy; CT – chemotherapy; HPV – human papilloma virus; AJCC – American Joint Committee on Cancer.

Table 3

EORTC QLQ - H&N35 scores depending on the investigated parameters (all values are expressed as mean value ± standard deviation)

Characteristics	Pain	Swallowing	Senses	Speech	Eating	Contact	Sexuality	Teeth	Opening mouth	Dry mouth	Saliva	Coughing	Feel ill	Pain killers	Supplements	Feeding tube	Weight loss	Weight gain
Gender																		
male	30.5±27.6	29.1±26.9	9.7±19.7	17.2±21.3	26.2±26.1	8.2±22.1	30.2±30.8	14±28.8	23.7±34.8	44.9±37.8	52.4±36.6	29.5±26.5	21.2±26.8	44.9±50.1	5.8±23.5	1.4±12	29±45.7	10.3±30.6
female	26.1±28	35.2±26	25±29.3	27.8±22.9	39.3±31.1	23.6±24.1	64.8±40.4	9.2±19.5	29.6±37.7	59.2±4.6	52.9±42.6	33.3±30.2	37±30	44.4±51.1	16.7±38.3	0±0	50±51.4	16.7±38.3
Place of living																		
urban	27.1±26.4	33.2±26.5	15.6±25.2	20.4±22.8	30.7±27.6	12.9±25.1	39.7±37.3	14.8±29.8	26.4±36	56.1±37.8	55.2±36.5	31.2±27.3	27±28.6	47.6±50.3	7.9±27.2	1.6±12.6	28.6±45.5	12.9±33.8
rural	35.6±31.3	24.6±26.8	6.1±12.1	18.2±19.5	25.7±28.3	7.9±18.1	32.6±40.4	9.1±18.3	18.2±30.4	27.3±36.6	47±42	28.8±27.8	18.2±26.7	31.8±46.7	9.1±29.4	0±0	45.4±50.9	9.1±29.4
Living arrangement																		
single	33.6±27.4	33.3±29.2	16±23.8	26.3±25.8	34.9±29.9	18.5±27.8	54.3±40.7	7.4±23.3	30.8±35.7	56.8±42.2	58.7±40	35.8±26	33.3±26.1	66.7±48	7.4±26.7	0±0	33.3±48	15.4±36.8
in a partnership/ married	26.8±27.5	29±25.6	11.4±22.2	16.3±19.3	26.2±26.2	8.2±20.4	29.7±30.5	15.6±28.4	22.2±35.1	43.9±37.6	50±36.6	27.8±27.6	20.6±28.1	35±48.1	8.3±27.9	1.7±12.9	33.3±47.5	10±30.2
Level of education (E)																		
no formal																		
E/elementary school	35.8±29	35.3±29.3	15.6±26	22.6±23.3	34.9±29.5	16.4±26.1	42.9±35.1	10.1±22.8	32.3±36.8	43.4±37.7	44.4±37.9	33.3±26.3	31.3±30	60.6±49.6	6.1±24.2	3±17.4	39.4±49.6	9.1±29.2
secondary/high school	25.4±25.8	31.2±25.8	13.7±22.6	18.9±22.7	28.7±28.2	10.6±23.9	37.5±37.1	19.2±32.8	23.3±37.1	60.8±38.4	64.1±37.7	28.3±29.7	23.3±27.4	35±48.3	10± 30.4	0±0	32.5±47.4	15± 36.2
faculty/PhD	22.6±26.8	16.1±17.7	3.6±9.6	13.5±15.2	15.5±14.2	1.8±4.8	23.8±31.2	2.4±8.9	11.9±21.1	21.4±30.9	38.4±26.7	28.6±22.1	11.9±21.1	35.7±49.7	7.1±26.7	0±0	21.4±42.6	7.7±27.7
Employment position																		
laborer	29±25.7	34.7±29.3	17±26.9	20.6±24.5	33.2±30.3	12.8±26.8	37.8±32.6	15.3±29.1	26.4±37	54.2±38	56.2±38.4	30.5±27.4	25±27.9	45.8±50.3	8.3±27.9	2.1±14.4	35.4±48.3	10.4±30.9
technical worker	15± 25.4	14.2±16.2	5±11.2	14.4±20.3	16.7±17.57	14.2±18	33.3±47.16	10±22.5	16.7±36	46.7±39.1	56.7±41.7	33.3±35.1	16.7±17.6	20±42.2	0±0	0±0	30±48.3	30±48.3
administrative worker	22.9±7.9	43.7±14.2	16.7±23.6	19.4±19	35.4±23.97	0±0	41.7±41.97	25±50	33.3±27.2	75±50	22.2±38.5	25±31.9	33.3±27.2	75±50	25±50	0±0	25±50	0±0
manager	27.8±32.7	20±22.9	3.3±9.3	16.3±18.2	16.1±3.9	1.7±4.7	24.4±30.1	2.2±8.6	17.8±30.5	20±30.3	42.8±30.5	26.7±22.5	15.5±24.8	40±50.7	6.7±25.8	0±0	20±41.4	7.1±26.7
unemployed	45.4±30.6	37±23.6	14.8±19.4	24.7±19	37.9±33.9	23.1±27.2	55.5±43.3	18.5±29.4	29.6±38.9	55.6±37.2	59.2±36.4	29.6±26	37±38.9	55.5±52.7	11.1±33.3	0±0	55.5±52.7	11.1±33.3
HPV status																		
positive	38.8±25.4	42.1±26	30.7±25.7	29.2±14.3	26.7±26.4	10.2±25.1	36.8±30.8	13±224.2	25.6±34.6	48.6±30.1	59.2±36.6	33.5±25.2	28.2±28.5	43.5±42.1	5.8±28.4	0.0±0	30.2±35.7	15.6±30.2
negative	22.1±26	35.4±28.2	7±29.6	15.8±20.5	31.3±29.9	13.6±28.5	44.7±30	10.2±21.4	26.6±36.7	52.3±24.9	50.7±35.3	36.7±30.6	33.9±30.7	46.8±40.1	9.7±39.1	0±0	36.5±36.6	18.9±30.6
AJCC Stage																		
I	40±21.8	39.2±21.5	31.7±30.9	30±26.2	35.8±25.5	23.3±26.9	55±31.5	16.7±28.3	36.7±42.9	63.3±33.1	59.2±32.4	43.3±31.6	40±26.3	40±51.6	0±0	0±0	40±51.6	0±0
II	32.1±33.1	28.6±27.6	26.2±38.3	17.5±20.1	26.2±36.8	10.7±19.7	42.8±46	14.3±26.2	14.3±26.2	52.4±42.4	61.9±44.8	33.3±33.3	28.6±40.5	42.8±53.4	14.3±37.8	0±0	14.3±37.8	0±0
III	27.8±32.6	26.7±21.1	6.2±13.7	20.8±22	21.2±16.5	6.6±17	35.4±37.8	16.7±32.6	20.8±35.2	48.6±40.5	61.1±36.3	27.8±28.9	20.8±29.2	37.5±49.4	12.5±33.8	0±0	16.7±38.1	20.8±41.5
IV	25.8±24.7	27.5±29.5	8.3±17.7	15.5±20.7	29.4±29.6	9.8±22.7	32.1±31.9	11.7±25.6	24.2±35.4	40.8±40.3	42.5±38.5	28.3±22.1	24.2±26.1	52.5±50.6	7.5±26.7	2.5±15.8	47.5±50.6	12.5±33.5
Treatment modality																		
OP	28.7±22.9	37.9±24	22.2±32.3	21±18.8	26.8±21.1	19.4±25.7	48.1±37.7	18.5±24.2	22.2±37.3	48.1±41.2	55.3±35.3	25.9±36.4	33.3±23.6	33.3±50	11.1±33.3	0±0	55.6±52.7	11.1±33.3
RT	37.5±35.1	21.9±21.3	16.7±23.7	22.2±24.5	30.2±35.6	15.6±26.5	58.3±42.7	12.5±35.3	16.7±30.9	54.1±43.4	45.8±50.2	31.7±23.6	33.3±39.8	50±53.4	0±0	0±0	12.5±35.3	25±46.3
OP+RT	26.8±25.5	30.2±28.6	14.2±25.6	21.8±27.1	31.2±29.5	13.6±29.4	31.5±37.9	11.1±26.1	23.4±34.4	56.8±41.1	49.4±35	33.3±29.2	23.4±28.9	37±49.2	7.4±26.7	0±0	22.2±42.3	7.7±27.2
RT+CT,	38.6±30	37.3±29.7	8±16.9	18.5±19.7	33±30.1	8±18.8	38.3±30.2	12.3±26.4	29.6±39.6	48.3±36.6	37±35.1	25.9±25	27.1±29.3	62.9±49.2	11.1±32	0±0	44.4±50.6	14.8±36.2
OP+RT+CT	14.6±17.1	18.7±17.9	11.4±20	14.6±17.1	18.7±16.8	6.8±14.3	29.1±34.1	14.6±29.7	25±33.3	45.8±38.2	50±38.5	29.1±24	12.5±16.7	31.2±47.9	6.2±25	6.2±25	31.2±47.9	6.2±25

EORTC QLQ-H&N35 – European Organization for Research and Treatment of Cancer Quality of -Life Questionnaire-Head and Neck 35; OP – operation; RT – radiotherapy; CT – chemotherapy; HPV – human papilloma virus; AJCC – American Joint Committee on Cancer.

Table 4

Statistical differences between the European Organization for Research and Treatment of Cancer Quality-of Life-Questionnaire-C30 (EORTC QLQ-C30) and the European Organization for Research and Treatment of Cancer Quality of- Life Questionnaire-Head and Neck 35 (EORTC QLQ-H&N35) scores depending on the investigated parameters

EORTC QLQ-C30	Parameters (*t*-test; *p*-values)	EORTC QLQ-H&N35	Parameters (ANOVA; *p*-values)
	Gender (male vs. female)		Education (E)
Physical functioning	0.018		no formal E/elementary school vs. faculty/PhD
		Global quality of life	0.039
Emotional functioning	0.01	Dyspnea	0.033
Cognitive functioning	0.002		secondary/high school-faculty/PhD
		Dry mouth	0.004
Social functioning	0.028		HPV status* positive vs. negative
Fatigue	0.001	Pain	0.024
Dyspnea	0.045	Dyspnea	0.043
Insomnia	0.001	Senses	0.26
Appetite loss	0.044		Employment position (manager–unemployed)
Senses	0.48	Insomnia	0.046
Contact	0.12		AJCC stage
	Place of living (urban vs. rural)	Physical functioning	I vs. III: 0.2
Senses	0.022		I vs. IV: 0.008
Dry mouth	0.003	Appetite loss	II vs. III: 0.025
Nausea	0.016	Senses	I vs. III: 0.221
Dyspnea	0.036		I vs. IV: 0.25
	Living arrangement (single vs. in a partnership/married)	Weight loss	II vs. III: 0.2 II vs. IV: 0.23
Emotional functioning	0.048		Treatment modality
Cognitive functioning	0.046	Pain	RT+CT vs. OP+RT+CT: 0.017
Sexuality	0.008	Social functioning	OP vs. RT+CT: 0.033
Feel ill	0.049		
Pain killers	0.006		

*** *t*-test (*p*-value); OP – operation; RT – radiotherapy; CT – chemotherapy; AJCC – American Joint Committee on Cancer; HPV – human papilloma virus.**

The Pearson's correlation test was used to determine the correlation among the EORTC QLQ-C30, EORTC QLQ-H&N35 and KPS Index and other parameters (Table 5). The KPS Index scores did not correlate with any of the variables. Older age of the patients correlated positively with sexuality in the patients, and negatively with occurrence of diarrhea. The level of education correlated positively with the global quality of life and cognitive functioning, and negatively with symptoms of nausea, dyspnea, appetite loss, swallowing, eating and feeling ill. Different employment positions did not correlate with the EORTC QLQ-C30, EORTC QLQ-H&N35 scores. There was a negative correlation among the stages of the disease and physical and emotional functioning scores, also with occurrence of dyspnea, insomnia and swallowing. The more combined therapy modalities patient had, significantly the worse emotional and social functionings were.

Table 5

Significant correlations ($p < 0.05$) between examined parameters and the score values of EORTC QLQ-C30, EORTC QLQ-H&N35 (Pearson's correlation test)

Parameters	Questionnaires	r
	EORTC QLQ-C30	
Age	Diarrhea	-0.228
Level of education	Role functioning	0.221*
	Cognitive functioning	0.253
	Nausea	-0.229
	Dyspnea	-0.288
	Appetite loss	-0.237
AJCC stage of the disease	Emotional functioning	-0.290
	Physical functioning	-0.327
	Social functioning	0.218
	Dyspnea	-0.234
	Insomnia	-0.223
Treatment modality	Emotional functioning	-0.319
	Social functioning	-0.366
	Nausea	-0.236
	Dyspnea	-0.272
	Insomnia	-0.253
	EORTC QLQ-H&N35	
Age	Sexuality	0.215
Level of education	Eating	-0.229
	Feel ill	-0.235
	Swallowing	-0.225
AJCC stage of the disease	Senses	-0.298

EORTC QLQ-C30 – European Organization for Research and Treatment of Cancer Quality-of Life-Questionnaire-C30; EORTC QLQ-H&N35 – European Organization for Research and Treatment of Cancer Quality of-Life Questionnaire-Head and Neck 35; AJCC – American Joint Committee on Cancer; r – Pearson's correlation coefficient.
***statistically significant correlation.**

Discussion

Oropharyngeal cancer has become a growing concern, with rising incidence in the younger male patients [6]. With developing more advanced strategies of head and neck cancer treatment [14, 15], locoregional control of the disease along with the disease-specific survival are significantly better. The expected QOL should be an important factor in choosing an adequate treatment modality, due to its immense influence on the patients' social, physical, psychological and overall functioning [16]. Clinicians are turning to the QOL measures for decision making in daily practice, improving the patient-doctor interaction and monitoring the patient experience with the treatment [17, 18].

Most of the parameters of QOL, are assessed at the lowest 3 months after treatment [17], but in the disease free head and neck patients major improvements in scores happen one year post-treatment [19, 20]. The assessment of QOL parameters in our study was done in that period, which is considered to be a good time for the assessment of QOL, because most of the QLQ-C30 and QLQ-H&N35 scores return to the preoperative values, depending on the treatment [21], and the variations are considered negligible in the absence of recurrent disease [22].

During this study, the demographic and social factors significantly influenced QOL and functional performance in the patients with oropharyngeal cancer, in addition to the stage of the disease and treatment modality. This results were already proven to be significant [23, 24]. Considering the different oropharyngeal sub sites involved, treatment is associated with a wide range of functional and psychosocial deficits. The multiple QOL segments are influenced and the patients are forced to make permanent changes in their eating habits, swallowing, appearance and communication. It is reasonable to expect differences in QOL between the patients treated for oropharyngeal carcinoma depending on their age, marital and educational status and employment. In this study, the women had significantly worse scores in many aspects of functioning, and also regarding fatigue, dyspnea, insomnia, and appetite loss, senses, contacts and sexuality, making gender significant factor which influences the QOL scores in these patients. Marital status influenced limited aspects of QOL, mostly emotional and cognitive functionings, sexual life and felling ill. There were significant differences noted in the patients living in rural areas; they had fewer problems with the senses, dry mouth, felt less nauseous and dyspneic, than those living in urban areas. There are studies that noted the differences in the emotional, functional, and head and neck cancer-specific scores between head and neck cancer survivors living in rural and urban areas, in term of better QOL in rural ones [25].

The level of education significantly influenced some the QOL aspects, like global QOL and cognitive functioning, nausea, dyspnea, appetite loss, swallowing, eating and feeling ill. This was generally noticed in the patients with head and neck carcinoma [23, 26]. Few possible explanations were offered. The patients with the lower education level and lower socioeconomic classes have less accessible health care, which leads to delays in diagnosis and treatment [23]. Some authors suggested that the patients with higher social and cultural level had a better capability of coping with cancer and its consequences. Comparing to the patients with higher education and less physically demanding workplace, the patients with employment that requires physical strength are more likely to be influenced by the disease, and have more trouble in adaptation to other work positions [26]. Considering the

structure of patients in our study, with 83.8% with high-school education and lower and 44% working as laborers, these claims are highly applicable.

The relation between HPV and QOL was explored in a few studies [27, 28]. Sharma et al. [28] found no association between HPV status and QOL one year post-treatment. On the other hand, Maxwell et al. [29] published that the HPV positive patients had significantly better scores considering activity, recreation, swallowing, chewing, speech and overall quality of life a year after the treatment. Production of saliva in the HPV positive patients was poorer comparing to the HPV negative patients in first 12 months, but after that time, the difference was no longer significant. A year after the treatment, the HPV positive patients in our study significantly less complained of pain, dyspnea and on trouble with their senses. Global QOL was better in the HPV positive patients, but differences were not significant. Due to favorable reaction to radiotherapy and better survival rates, we could argue that the HPV positivity surely influences postoperative QOL in the patients with oropharyngeal carcinoma. Recommended modality treatment depending on the HPV status would certainly be a subject for further discussion, with more knowledge accumulated on the subject.

A stage of disease, cancer site, and treatment type are the predictors of post-treatment QOL, particularly disease-specific symptoms [30]. In this study, the patients with more advanced stage of the disease scored worse than those with less advanced stage of the disease in all aspects of QLQ-C30, QLQ-H&N35 and KPS Index scale, which is consistent with previous papers on the subject [30, 31]. Significant differences were noted in physical functioning and with the senses between patients in the stage I of the disease and patients in the stages III and IV of the disease. Oates et al.[30] reported great deterioration of senses, teeth, saliva secretion and coughing in the patients with early-stage cancer and significant deterioration of sexual function and complains of dry mouth in the patients 12 months after the treatment for all four stages of the disease. The findings of statistically significant differences in the QOL scores favoring patients receiving a single therapy compared to the combination therapies are not consistent across studies [19]. In our patients, social functioning was significantly better for those who underwent operative treatment than for those treated operatively with postoperative radiochemotherapy or just with adjuvant radiochemotherapy. Also, the pain was significantly more severe in the patients treated operatively with radiochemotherapy, than in the patients treated only with radiochemotherapy. Some authors published similar findings [27, 31, 32], but in most studies, the results were inconclusive [33, 34]. Good oncological results are the first objective of treatment, but functional preservation could be one of the main challenges after surgical treatment or radiochemotherapy. Comparing to surgery, the patients were primary treated with chemoradiotherapy [35] or with adjuvant therapy [36, 37]. In our study, there were some differences in the functional aspects (eating, swallowing, complaints of dry mouth and saliva production), but they were not significant between the groups of patients considering the treatment modality. Our findings could have been strongly influenced by the time of evaluation. The differences between the QOL scores in the patients treated with different treatment modalities proved to be the greatest 3 months after the treatment, and by 6 and 12 months of follow-up, they were significantly less pronounced [30].

With rising incidence of patients diagnosed with oropharyngeal cancer, there is a great need for better understanding of recovery process, that significantly influences post-treatment QOL and how to educate the patients in terms what to expect after the treatment. After diagnosis and treatment of oropharyngeal cancer, the patients go back to their family and living environment, with distinct personal, social, and economic expectations and duties. These factors are of little variability and are constantly present in the patients' lives pre and post-treatment and it would be crucial to recognize their important influence on overall recovery and survival.

There are some limitations of the study. First, the study assessed QOL and functional performance in the patients with oropharyngeal cancer at a time point, not prospectively, so any changes between the influence of sociodemographic factors and QOL over time was not followed. Second, the number of patients in the study was small and the results of this study should be evaluated cautiously. Last, a number of patients with different subsites of the oropharyngeal carcinoma was also small and it was not analyzed how different oropharyngeal subsites involvement influenced QOL and functional performance.

Conclusion

Clinicians should have in mind the socioeconomic factors and HPV status when planning recovery course after treatment in the patients with oropharyngeal carcinoma. Gender, education level and employment are the variables that form certain risk profiles associated with lower post-treatment QOL. This would ultimately lead to the better functional results, faster recovery and return to everyday life and activities in the patients with oropharyngeal cancer.

Conflict of interest

None.

REFERENCES

1. *Lambert R, Sauvaget C, de Camargo Cancela M, Sankaranarayanan R.* Epidemiology of cancer from the oral cavity and oropharynx. Eur J Gastroenterol Hepatol 2011; 23(8): 633–41.
2. GLOBOCAN. 2012. Available from: http://globocan.iarc.fr/old/summary_table_site_prev.asp?selection=13010&selection=21030&title=Lip%2C+oral+cavity%2C+Other+pharynx&sex=0&africa=1&america=2&asia=3&europe=4&oceania=5&build=6&window=1&so
3. *Warnakulasuriya S.* Global epidemiology of oral and oropharyngeal cancer. Oral Oncol 2009; 45(4–5): 309–16.
4. *Chandu A, Smith AC, Rogers SN.* Health-related quality of life in oral cancer: A review. J Oral Maxillofac Surg 2006; 64(3): 495–502.

5. *Chaturvedi AK, Engels EA, Pfeiffer RM, Hernandez BY, Xiao W, Kim E*, et al. Human papillomavirus and rising oropharyngeal cancer incidence in the United States. J Clin Oncol 2011; 29(32): 4294–301.
6. *Weatherspoon DJ, Chattopadhyay A, Boroumand S, Garcia I*. Oral cavity and oropharyngeal cancer incidence trends and disparities in the United States: 2000-2010. Cancer Epidemiol 2015; 39(4): 497–504.
7. *Cleveland JL, Junger ML, Saraiya M, Markowitz LE, Dunne EF, Epstein JB*. The connection between human papillomavirus and oropharyngeal squamous cell carcinomas in the United States: Implications for dentistry. J Am Dent Assoc 2011; 142(8): 915–24.
8. *Iyer GN, Dogan S, Palmer F, Rahmati R, Nixon IJ, Lee N,* et al. Detailed Analysis of Clinicopathologic Factors Demonstrate Distinct Difference in Outcome and Prognostic Factors Between Surgically Treated HPV-Positive and Negative Oropharyngeal Cancer. Ann Surg Oncol 2015; 22(13): 4411–21.
9. *Morton RP*. Studies in the quality of life of head and neck cancer patients: Results of a two-year longitudinal study and a comparative cross-sectional cross-cultural survey. Laryngoscope 2003; 113(7): 1091–103.
10. *Singhi AD, Westra WH*. Comparison of human papillomavirus in situ hybridization and p16 immunohistochemistry in the detection of human papillomavirus-associated head and neck cancer based on a prospective clinical experience. Cancer 2010; 116(9): 2166–73.
11. *Cai C, Chernock RD, Pittman ME, El-Mofty SK, Thorstad WL, Lewis JS*. Keratinizing-type squamous cell carcinoma of the oropharynx: P16 overexpression is associated with positive high-risk HPV status and improved survival. Am J Surg Pathol 2014; 38(6): 809–15.
12. *Bjordal K, Ahlner-Elmqvist M, Hammerlid E, Boysen M, Evensen JF, Biörklund A,* et al. A prospective study of quality of life in head and neck cancer patients. Part II: Longitudinal data. Laryngoscope 2001; 111(8): 1440–52.
13. *Karnofsky DA, Burchenal JH*. The clinical evaluation of chemotherapeutic agents in cancer. In: *MacLeod CM*, editor. Evaluation of chemotherapeutic agents. New York: Columbia University Press; 1949. p. 196–7.
14. *Röösli C, Tschudi DC, Studer G, Braun J, Stoeckli SJ*. Outcome of patients after treatment for a squamous cell carcinoma of the oropharynx. Laryngoscope 2009; 119(3): 534–40.
15. *Yasumatsu R, Nakashima T, Komune S*. Squamous cell carcinoma of the oropharynx: single-institution outcome analysis of patients treated with concurrent chemoradiotherapy. J Laryngol Otol 2015; 129 Suppl 2: S77–82.
16. *Broglie MA, Soltermann A, Haile SR, Röösli C, Huber GF, Schmid S*, et al. Quality of life of oropharyngeal cancer patients with respect to treatment strategy and p16-positivity. Laryngoscope 2013; 123(1): 164–70.
17. *Binenbaum Y, Amit M, Billan S, Cohen JT, Gil Z*. Minimal clinically important differences in quality of life scores of oral cavity and oropharynx cancer patients. Ann Surg Oncol 2014; 21(8): 2773–81.
18. *Schunemann HJ, Akl EA, Guyatt GH*. Interpreting the results of patient reported outcome measures in clinical trials: The clinician's perspective. Health Qual Life Outcomes 2006; 4: 62.
19. *Infante-Cossio P, Torres-Carranza E, Cayuela A, Hens-Aumente E, Pastor-Gaitan P, Gutierrez-Perez JL*. Impact of treatment on quality of life for oral and oropharyngeal carcinoma. Int J Oral Maxillofac Surg 2009; 38(10): 1052–8.
20. *Bozec A, Peyrade F, Milano G*. Molecular targeted therapies in the management of head and neck squamous cell carcinoma: Recent developments and perspectives. Anticancer Agents Med Chem 2013; 13(3): 389–402.
21. *Al-Mamgani A, Rooij P, Tans L, Verduijn GM, Sewnaik A, Baatenburg JR*. A prospective evaluation of patient-reported quality-of-life after (chemo) radiation for oropharyngeal cancer: Which patients are at risk of significant quality-of-life deterioration. Radiother Oncol 2013; 106(3): 359–63.
22. *Pierre CS, Dassonville O, Chamorey E, Poissonnet G, Ettaiche M, Santini J,* et al. Long-term quality of life and its predictive factors after oncologic surgery and microvascular reconstruction in patients with oral or oropharyngeal cancer. Eur Arch Otorhinolaryngol 2014; 271(4): 801–7.
23. *Vartanian JG, Carvalho AL, Toyota J, Kowalski IGS, Kowalski LP*. Socioeconomic effects of and risk factors for disability in long-term survivors of head and neck cancer. Arch Otolaryngol Head Neck Surg 2006; 132(1): 32–5.
24. *Demiral AN, Sen M, Demiral Y, Kinay M*. The effect of socioeconomic factors on quality of life after treatment in patients with head and neck cancer. Int J Radiat Oncol Biol Phys 2008; 70(1): 23–7.
25. *Thomas AA, Timmons A, Molcho M, Pearce A, Gallagher P, Butow P*, et al. Quality of life in urban and rural settings: A study of head and neck cancer survivors. Oral Oncol 2014; 50(7): 676–82.
26. *Terrell JE, Ronis DL, Fowler KE, Bradford CR, Chepeha DB, Prince ME,* et al. Clinical predictors of quality of life in patients with head and neck cancer. Arch Otolaryngol Head Neck Surg. 2004; 130(4): 401–8.
27. *Allal AS, Nicoucar K, Mach N, Dulguerov P*. Quality of life in patients with oropharynx carcinomas: Assessment after accelerated radiotherapy with or without chemotherapy versus radical surgery and postoperative radiotherapy. Head Neck 2003; 25(10): 833–9; discussion 839-40.
28. *Sharma A, Méndez E, Yueh B, Lohavanichbutr P, Houck J, Doody DR*, et al. Human papillomavirus-positive oral cavity and oropharyngeal cancer patients do not have better quality-of-life trajectories. Otolaryngol Head Neck Surg 2012; 146(5): 739–45.
29. *Maxwell JH, Mehta V, Wang H, Cunningham D, Duvvuri U, Kim S,* et al. Quality of life in head and neck cancer patients: Impact of HPV and primary treatment modality. Laryngoscope 2014; 124(7): 1592–7.
30. *Oates J, Davies S, Roydhouse JK, Fethney J, White K*. The effect of cancer stage and treatment modality on quality of life in oropharyngeal cancer. Laryngoscope 2014; 124(1): 151–8.
31. *Bjordal K, de Graeff A, Fayers PM, Hammerlid E, van Pottelsberghe C, Curran D,* et al. A 12country field study of the EORTC QLQ-C30 (version 3.0) and the head and neck cancer specific module (EORTC QLQ-H&N35) in head and neck patients. EORTC Quality of Life Group. Eur J Cancer 2000; 36(14): 1796–807.
32. *Kim TW, Youm H, Byun H, Son Y, Baek C*. Treatment Outcomes and Quality of Life in Oropharyngeal Cancer after Surgery-based versus Radiation-based Treatment. Clin Exp Otorhinolaryngol 2010; 3(3): 153–60.
33. *Boscolo-Rizzo P, Stellin M, Fuson R, Marchiori C, Gava A, Da Mosto MC*. Long-term quality of life after treatment for locally advanced oropharyngeal carcinoma: Surgery and postoperative radiotherapy versus concurrent chemoradiation. Oral Oncol 2009; 45(11): 953–7.
34. *Mowry SE, Ho A, Lotempio MM, Sadeghi A, Blackwell KE, Wang MB*. Quality of life in advanced oropharyngeal carcinoma after chemoradiation versus surgery and radiation. Laryngoscope 2006; 116(9): 1589–93.
35. *Chen AM, Daly ME, Luu Q, Donald PJ, Farwell GD*. Comparison of functional outcomes and quality of life between transoral surgery and definitive chemoradiotherapy for oropharyngeal cancer. Head Neck 2015; 37(3): 381–5.
36. *Günzel T, Schimmer M*. Quality of life after primary radiation/radiochemotherapy vs. operation therapy in an oropharyngeal cancer. Laryngorhinootologie 2012; 91(7): 451–6; quiz 457–9. (German)
37. *Mendenhall WM, Amdur RJ, Morris CG, Kirwan JM, Li JG*. Intensity modulated radiotherapy for oropharyngeal squamous cell carcinoma. Laryngoscope 2010; 120(2): 218–22.

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