

The impact of radiotherapy on quality of life for cancer patients: a longitudinal study

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Abstract

Purpose The aim of this study was to assess for changes in quality of life (QOL) among cancer patients who undergo radiotherapy (RT) and to identify factors that influence QOL in this group.

Materials and methods Three hundred sixty-seven cancer patients who received curative RT were investigated using the EORTC QLQ-C30 questionnaire at the start of RT, end of RT, and 1 and 6 months post-RT.

Results The patients were 49 % women, 51 % men, and median age at diagnosis was 57 years (range, 16–86 years). Compared to pre-RT, at the end of RT, the global health status score ($p<0.001$), nausea/vomiting ($p<0.001$), and appetite loss scores ($p<0.001$) were significantly poorer. Compared to the end of RT, at 1 and 6 months post-RT, global health status, all functional, and all symptom scores were significantly improved ($p<0.001$). Patient sex influenced scores for pain ($p=0.036$), appetite loss ($p=0.027$), and financial difficulty ($p=0.003$). Performance status influenced scores for global health status ($p=0.006$), physical functioning ($p<0.001$), cognitive functioning ($p=0.001$), and role functioning ($p=0.021$). Comorbidity influenced fatigue score ($p<0.001$). Cancer stage influenced scores for physical functioning ($p=0.001$), role functioning ($p=0.010$), and fatigue ($p<0.001$). Treatment modality (chemoRT vs. RT alone) influenced scores for physical functioning ($p=0.016$), fatigue ($p<0.001$), nausea/vomiting ($p=0.009$), and appetite loss ($p<0.001$); and RT field influenced scores for nausea/vomiting ($p=0.001$), appetite loss ($p=0.003$), and diarrhea ($p=0.037$). Radiotherapy dose influenced scores for physical functioning ($p<0.001$), cognitive functioning ($p<0.001$), social functioning ($p<0.001$), fatigue ($p<0.001$),

and pain (<60 vs ≥ 60 Gy) had an effect on scores for physical functioning ($p<0.001$), role functioning ($p<0.001$), emotional functioning ($p<0.001$), insomnia ($p<0.001$), constipation ($p<0.001$).

Conclusion While RT negatively affects cancer patients' QOL, restoration tends to be rapid and patients report significant improvement by 1 month post-RT. Various patient- and disease-specific factors and RT modality affect QOL in this patient group. We advocate measuring cancer patients' QOL regularly as part of routine patient management.

Keywords Cancer · Radiotherapy · EORTC QLQ-C30 questionnaire

Introduction

Cancer is being diagnosed more and more frequently worldwide, and advances in treatment are extending survival time for cancer patients. The traditional endpoints in cancer clinical trials typically include tumor control rate, overall survival, or disease-free survival; however, it is also important to consider quality of life (QOL) for this patient group. Over the past 30 years, cancer researchers have used various methods to evaluate the efficacy of therapeutic interventions based on their impacts on health-related QOL [1]. These efforts have led to a relatively recent shift in the aim of cancer treatments from strictly prolonging life to also maintaining QOL for as long as possible.

The Core Quality of Life Questionnaire developed by the European Organization for Research and Treatment of Cancer (EORTC QLQ-C30) is an instrument for assessing health-related QOL in cancer patients [2]. This instrument is reliable, validated, and feasible to use in research and is the questionnaire most widely used in cancer clinical trials worldwide [3]. Cross-cultural adaptability of the EORTC QLQ-C30 has been evaluated with testing in more than 24 countries [2, 4, 5].

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Radiotherapy (RT) is used in approximately half of all cancer cases and is applied as a component of curative and/or palliative treatment. While RT can have health benefits for cancer patients, its side effects can negatively impact QOL. There is a need to objectively examine the ways in which RT affects QOL in this patient group. The aims of this study were to assess for changes in QOL among cancer patients who receive RT and to identify factors that influence QOL in this patient group.

Materials and methods

The Departmental Ethics Committee of Cumhuriyet University's School of Medicine approved this study in accordance with the Declaration of Helsinki. Three hundred sixty-seven cancer patients who underwent RT in the Radiation Oncology Department of Cumhuriyet University School of Medicine between January 2010 and June 2012 were enrolled. All cancer patients who received curative RT were considered eligible. Those who received palliative RT were excluded.

In all cases, RT was performed using a linear accelerator device (Varian Clinac DHX, Varian Medical Systems, Inc., Palo Alto, CA, USA). Three-dimensional conformal RT planning was done using ECLIPS version 8.6 software (Varian Medical Systems, Inc., Palo Alto, CA, USA). Doses of RT ranged from 45 to 74 Gy.

Prior to treatment, each patient's performance status was scored according to the Eastern Cooperative Oncology Group (ECOG) Scoring System [6]. Cancers were classified based on system or body site affected: central nervous system, head and neck, thorax, breast, gastrointestinal system, genitourinary system, gynecological, skin and soft tissue, and hematological malignancies. Stage of disease was evaluated according to the 2010 TNM classification developed by the International Union Against Cancer and the American Joint Committee on Cancer. Radiotherapy field was categorized as one of six sites: cranium, head and neck, breast, thorax, abdomen, or pelvis. In addition to these data, demographic and histopathological data for the 367 patients were obtained from hospital records.

Quality of life scale

Quality of life was assessed using the EORTC QLQ-C30 version 3.0, a 30-item questionnaire. The components of the EORTC QLQ-C30 are global health status, five functional scales (physical, role, cognitive, emotional, social), and nine symptom scales/items (fatigue, nausea/vomiting, pain, dyspnea, insomnia, appetite loss, constipation, diarrhea, financial difficulties). Patients' responses were scored according to the EORTC QLQ-C30 scoring manual [7]. Scores for the

symptom components were linearly transformed to a scale of 0 to 100. A high score for a functional scale represented a relatively high level of functioning, whereas a high score for a symptom scale represented greater severity of symptoms or financial impact [8]. Each patient completed the EORTC QLQ-C30 at four different time points: the start of RT (T_1); the end of RT (T_2); 1 month after completion of RT (T_3); 6 months after completion of RT (T_4).

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS version 15.0 for Windows; SPSS, Chicago, IL, USA). Medians and frequencies were calculated for patient demographics. Questionnaire scores were compared across the four time points using repeated-measures analysis of variance (ANOVA). Effects of multiple variables (gender, presence of comorbidity, ECOG performance status, cancer stage, RT field, and RT treatment modality) on changes in QOL over time were analyzed using two-way repeated-measures analysis of variance (MANOVA). A $p \leq 0.05$ was considered to indicate statistical significance.

Results

Table 1 summarizes the patients' demographic and clinical characteristics. The patients were 181 (49 %) men and 186 (51 %) women. Their median age at time of cancer diagnosis was 57 years (range, 16–86 years). Ranked in order of frequency, the cancer classifications were breast ($n=101$, 28 %), gastrointestinal ($n=93$, 25 %), head and neck ($n=55$, 15 %), genitourinary ($n=30$, 8 %), lung ($n=26$, 7 %), central nervous system ($n=23$, 6 %), gynecological ($n=19$, 5 %), hematological ($n=12$, 3 %), and skin and soft tissue ($n=8$, 2 %). One hundred and ninety-five patients (53 %) were treated with RT alone, the remaining 172 (47 %) with chemoradiotherapy (chemoRT). Regarding RT field, 101 patients (27 %) were irradiated in the breast, 91 (25 %) in the pelvis, 65 (18 %) in the head and neck, 54 (15 %) in the abdomen, 32 (9 %) in the thorax, and 24 (6 %) in the cranium.

Table 2 summarizes the EORTC QLQ-C30 QOL results at the four time points. The questionnaire response rates were 100 % ($n=367$) at T_1 , 100 % ($n=366$) at T_2 , 96 % ($n=351$) at T_3 , and 86 % ($n=316$) at T_4 . Compared to scores at T_1 , at T_2 , the mean global health status score ($p=0.024$) were significantly lower, and mean nausea/vomiting scores ($p=0.034$) and mean appetite loss score ($p<0.001$) were significantly higher. However, compared to findings at T_2 , at T_3 and T_4 , the mean global health status scores and all mean functional scores were significantly higher and all mean symptom scores were significantly lower.

Table 1 Demographic and clinical characteristics of the patients ($n=367$)

	No. (%)
Sex	
Male	181 (49)
Female	186 (51)
Performance status	
ECOG-0	302 (82)
ECOG-1	48 (13)
ECOG-2	17 (5)
Comorbidity	
Hypertension	153 (42)
Diabetes mellitus	102 (28)
Coronary artery disease	54 (15)
Chronic obstructive lung disease	33 (9)
Chronic obstructive lung disease	20 (5)
Stage ($n=320$) ^a	
Stage I	51 (16)
Stage II	118 (37)
Stage III	117 (37)
Stage IV (without distant metastases)	34 (10)
Treatment	
RT	195 (53)
ChemoRT	172 (47)
Chemotherapy after radiotherapy	155 (42)
RT field	
Breast	101 (27)
Pelvis	91 (25)
Head and neck	65 (18)
Abdomen	54 (15)
Thorax	32 (9)
Cranium	24 (6)
Radiation dose	
<60 Gy	204 (55)
≥60 Gy	145 (45)

^a Excludes patients with certain cancers (brain tumors, rectal cancer) who had undergone preoperative chemoRT

ECOG Eastern Cooperative Oncology Group, RT radiotherapy, ChemoRT chemoradiotherapy

Table 3 shows comparisons of questionnaire scores at the four time points with patients categorized by sex, presence of comorbidity, and ECOG performance status. Analysis revealed that patient sex had an effect on scores for pain, appetite loss, and financial difficulty; performance status had an effect on scores for global health status, physical functioning, cognitive functioning, and role functioning; comorbidity had an effect on fatigue score.

Table 4 lists comparisons of questionnaire scores at the four time points with patients categorized by cancer stage, treatment modality (RT alone versus chemoRT), and RT field. Analysis revealed that cancer stage had an effect on scores for physical functioning, role functioning, and fatigue, with

patients at more advanced stages having worse scores for these components. Treatment modality had an effect on scores for physical functioning, fatigue, nausea/vomiting, and appetite loss, with patients who received chemoRT having poorer scores. However, QOL scores of patients received chemotherapy after radiotherapy were not significantly changed ($p>0.050$). Radiotherapy field had an effect on scores for nausea/vomiting, appetite loss, and diarrhea, with the groups irradiated in the head and neck, abdomen and pelvis having the worst scores for these elements. Radiotherapy dose (<60 versus ≥60 Gy) had an effect on scores for physical functioning, role functioning, emotional functioning, cognitive functioning, social functioning, fatigue, pain, insomnia, and constipation (Table 5). Higher radiotherapy dose (≥60 Gy) had a negative effect on QOL scores such as physical functioning, role functioning, emotional functioning, fatigue, pain, insomnia, and constipation. However, there was not a negative effect on the scores of cognitive functioning and social functioning.

Discussion

To date, researchers have tended to focus on measuring global and/or cancer-specific QOL in cancer patients, whereas our study sample included various forms and stages of cancer. We found that RT affected our cancer patients' QOL negatively, but we also noted significant restoration of QOL by 1-month post-treatment. Further, we observed that QOL in our sample was affected not only by RT treatment modality but also by patient-specific factors (sex, performance status, comorbidity) and disease-specific factors (cancer stage and RT field).

There are several methods for treating cancer, and QOL is an important consideration when making medical decisions for these patients [9, 10]. In addition to the treatment choice that is ultimately made, the decision-making process itself can affect QOL [11]. As a curative treatment, RT is administered over weeks and has early and late side effects; thus, it is not surprising that this therapy can have long-term impacts on QOL. Longitudinal studies have the potential to demonstrate changes in cancer patients' QOL over time. The intervals of measurement in these investigations must be long enough for changes to occur, but also short enough to be able to ascribe changes to specific causes. The longer the duration between two measurements, the larger are the effects of uncontrollable influencing factors [1].

Budischewski et al. [1] used the EORTC QLQ-C30 to study QOL in 61 breast cancer patients at the beginning of RT and 6 weeks after RT was completed. These authors achieved a response rate of 68 % at their post-RT time evaluation, whereas our response rates for the same questionnaire at 1 and 6 months post-RT were 96 and 86 %, respectively. From the start of RT to 6 weeks after RT, Budischewski et al. reported significant improvement in role functioning,

Table 2 Comparisons of the EORTC QLQ-C30 questionnaire scores at the four time points

EORTC QLQ-C-30 Component	Item No./s	T ₁ (n=367)	T ₂ (n=366)	T ₃ (n=351)	T ₄ (n=316)	p (ANOVA)
Global health status	29–30	67±23	63±23	69±23	76±23	<0.001
Functional scale						
Physical	41,395	70±23	66±26	71±23	76±24	<0.001
Emotional	21–24	71±22	71±23	76±23	81±21	<0.001
Cognitive	20–25	76±22	78±20	80±23	82±21	<0.001
Social	26–27	77±24	76±24	83±20	89±19	<0.001
Role	41,461	72±29	69±35	73±27	76±27	0.009
Symptom scale/items						
Fatigue	10, 12, 18	32±23	35±23	29±22	22±22	<0.001
Nausea/vomiting	14–15	7±17	10±20	8±17	4±13	<0.001
Pain	9, 19	18±20	20±23	17±23	14±22	<0.001
Dyspnea	8	16±60	12±22	12±21	11±21	0.573
Insomnia	11	22±28	24±30	19±26	15±25	<0.001
Appetite loss	13	15±25	25±29	17±26	13±29	<0.001
Constipation	16	11±21	10±21	10±21	6±17	0.002
Diarrhea	17	7±24	9±20	7±17	4±14	<0.001
Financial difficulties	28	25±29	25±29	24±27	18±23	<0.001

Results are denoted as mean ± standard deviation

T₁ start of radiotherapy, T₂ end of radiotherapy, T₃ 1 month after completion of radiotherapy, T₄ 6 months after completion of radiotherapy

significantly poorer cognitive functioning, and observed no changes in global health status or physical, emotional, or social functioning [1].

In contrast, Bansal et al. [12] used the EORTC QLQ-C30 to evaluate 45 patients with head and neck cancer at three time points: the start of RT, fourth week of RT, and 1 month after RT. These authors found that global health status and physical, social, and emotional functioning all declined significantly during RT. One month after RT, they observed improvement in all the functional scale scores, but none had returned to pre-RT levels. Bansal et al. also reported that their patients' scores for role and cognitive functioning remained high during RT (i.e., in week 4 of therapy), and they observed no significant changes in these scales from pre-RT to post-RT. The same study revealed that, compared to pre-RT, the scores for fatigue, nausea/vomiting, pain, dyspnea, insomnia, appetite loss, and financial difficulties all increased significantly during the course of RT. At 1 month after RT, the scores for fatigue, pain, insomnia, and appetite loss remained high, whereas those for nausea/vomiting and dyspnea were significantly improved. Bansal et al. observed no changes in their patients' EORTC QLQ-C30 scores for constipation and diarrhea from pre-RT to 1 month after RT.

De Graeff et al. [13] prospectively evaluated changes in QOL for 107 patients with squamous cell carcinomas of the head and neck who underwent post-operative RT. The authors used the EORTC QLQ-C30 as well as the QLQ-H&N35, a questionnaire specific for patients with head and neck cancer

and applied these instruments before RT and 6, 12, 24, and 36 months after RT. Their results for EORTC QLQ-C30 at 6 months post-RT revealed significant deterioration in the scores for physical functioning, role functioning, emotional functioning, and fatigue; however, by 6 months later (12 months after RT), all these scores had improved significantly. Our findings with the EORTC QLQ-C30 in 367 patients with various forms of cancer were similar to those of De Graeff et al. Compared to the start of RT, at the end of RT, compared to baseline, at the end of RT, we observed significantly lower mean scores for global health status and significantly higher mean scores for nausea/vomiting and appetite loss. By 1 and 6 months post-RT, mean global health status scores, all mean functional scores, and mean symptom scores had improved significantly. We suspect that the regular measurements of QOL played a part in this.

Other researchers have also examined factors that influence QOL in cancer patients treated with RT. Tiv et al. [14] studied 207 patients with rectal cancer who were treated with pre-operative RT or pre-operative chemoRT. They applied the EORTC QLQ-C30 and the QLQ-CR38, a questionnaire specific for colorectal cancer patients, at a median follow-up 4.6 years. Results from the EORTC QLQ C-30 indicated that patient sex had a significant influence on the scores for some function scales and symptom scales/items. Specifically, the authors found that men felt better physically and were less fatigued by RT than women 4.6 years after the beginning preoperative treatment. Elumelu et al. [15] investigated 100

Table 3 Comparisons of scores for components of the EORTC QLQ-C30 questionnaire with patients categorized by sex, performance status, and presence of comorbidity

Category	EORTC QLO-C30 Component	T ₁ (n=367)	T ₂ (n=366)	T ₃ (n=351)	T ₄ (n=316)	p (MANOVA)
Sex	Pain					
	Males	19±24	20±25	15±24	17±24	0.036
	Females	18±21	21±21	19±23	12±19	
	Appetite loss					
	Males	17±27	32±31	19±27	15±26	0.027
	Females	13±24	18±26	15±25	11±33	
Financial difficulty						
Males	28±32	24±28	23±27	20±26	0.003	
Females	21±26	27±30	25±27	15±20		
ECOG PS	Global health status					
	ECOG-0	71±20	66±22	72±23	79±22	0.006
	ECOG-1	46±24	51±21	57±17	66±20	
	ECOG-2	34±23	40±15	38±13	33±24	
	Physical functioning					
	ECOG-0	74±19	71±20	75±21	79±22	<0.001
	ECOG-1	49±27	42±41	51±21	68±23	
	ECOG-2	27±33	43±26	38±21	31±28	
	Cognitive functioning					
	ECOG-0	76±21	80±19	82±20	84±20	0.001
	ECOG-1	78±23	69±24	67±30	74±22	
	ECOG-2	60±30	65±21	62±26	55±34	
	Role functioning					
	ECOG-0	27±26	73±35	78±25	78±25	0.021
	ECOG-1	50±31	52±30	52±26	70±28	
ECOG-2	30±29	42±26	42±38	32±30		
Comorbidity	Fatigue					
	Comorbidity	29±22	35±24	29±23	21±23	<0.001
	No comorbidity	38±23	36±21	31±21	25±21	

Results are denoted as mean ± standard deviation

ECOG the Eastern Cooperative Oncology Group, PS performance status, T₁ start of radiotherapy, T₂ end of radiotherapy, T₃ 1 month after completion of radiotherapy, T₄ 6 months after completion of radiotherapy

patients with head and neck cancer and applied the EORTC QLQ-C30 and QLQ-H&N35 (mentioned above) at the beginning and end of RT. At the end of RT, they observed that females' mean scores for role functioning, cognitive functioning, social functioning, dyspnea, and constipation were higher than those for males, whereas males had higher mean scores for fatigue, pain, insomnia, appetite loss, diarrhea, and financial difficulties. Males and females had almost equal scores for global health status, physical functioning, emotional functioning, and nausea/vomiting. However, Elumelu et al. [15] found no significant differences between the sexes for any of these scores. In contrast, our analysis revealed that patient sex influenced EORTC QLQ-C30 results for appetite loss, pain, and financial difficulties. Compared with the baseline measurement at the start of RT, females' mean scores for pain and

financial difficulties were significantly higher than males' at T₂ and T₃ (end of RT and 1 month post-RT, respectively), and males' mean scores for appetite loss, pain, and financial difficulties were all significantly higher than females' at T₄ (6 months post-RT).

Research has identified performance status as a good predictor of cancer patients' QOL [16, 17]. It has been shown that the number and severity of symptoms experienced by lung cancer patients increase as performance status deteriorates [18]. Guzelant et al. [19] evaluated correlations between EORTC QLQ-C30 scores and Karnofsky performance scale status (KPS) in 194 lung cancer patients and found that KPS was most strongly associated with certain functional scale scores. The strongest associations were with physical functioning, role functioning, and fatigue, whereas the weakest

Table 4 Comparison of scores for components of the EORTC QLQ-C30 questionnaire with patients categorized by cancer stage, treatment modality, and radiotherapy field

Category	EORTC QLO-C30 Component	T ₁ (n=367)	T ₂ (n=366)	T ₃ (n=351)	T ₄ (n=316)	p (MANOVA)
Stage	Physical functioning					
	Stage I	75±19	74±20	79±21	77±25	0.001
	Stage II	68±24	69±20	71±21	79±21	
	Stage III	71±20	67±24	72±23	79±21	
	Stage IV	67±25	45±48	58±23	66±31	
	Role functioning					
	Stage I	79±27	79±26	81±26	74±27	0.010
	Stage II	70±31	69±27	77±24	79±26	
	Stage III	74±26	69±230	71±28	78±25	
	Stage IV	67±32	50±77	61±28	69±33	
	Fatigue					
	Stage I	26±19	27±17	23±21	21±21	<0.001
Stage II	36±24	34±21	28±21	21±22		
Stage III	31±23	36±25	30±24	21±20		
Stage IV	32±22	49±21	43±20	31±28		
Treatment	Physical functioning					
	RT	70±24	70±28	75±22	79±23	0.016
	ChemoRT	69±22	61±22	66±24	73±24	
	Fatigue					
	RT	31±23	29±20	25±21	20±20	<0.001
	ChemoRT	33±23	43±24	35±23	26±24	
	Nausea/vomiting					
	RT	6±18	6±16	6±14	4.3±10	0.009
	ChemoRT	8±15	15±23	11±19	7±16	
	Appetite loss					
RT	14±25	16±24	11±21	9±19	<0.001	
ChemoRT	17±25	36±33	24±30	18±38		
Radiotherapy field	Nausea/vomiting					
	Cranium	17±32	8±14	14±21	7±14	0.001
	Head and neck	4±11	15±22	9±19	2±11	
	Breast	6±17	3±10	3±10	1±5	
	Thorax	5±15	10±15	4±15	2±7	
	Abdomen	13±20	22±29	15±18	10±16	
	Pelvis	5±12	10±19	11±19	7±19	
	Appetite loss					
	Cranium	21±38	21±29	21±32	19±27	0.003
	Head and neck	16±27	40±34	19±28	13±22	
	Breast	11±22	12±19	8±17	7±35	
	Thorax	12±22	17±22	11±19	14±20	
	Abdomen	19±28	40±34	28±32	20±27	
	Pelvis	17±25	26±28	21±28	15±28	
	Diarrhea					
	Cranium	10±20	2±8	2±8	4±17	0.037
	Head and neck	4±14	5±16	5±16	6±19	
	Breast	5±15	3±10	3±11	1±6	
	Thorax	2±7	6±13	3±10	0±0	
	Abdomen	8±16	10±19	11±17	7±16	
Pelvis	11±40	21±28	15±23	6±7		

Results are denoted as mean ± standard deviation

RT group that received radiotherapy alone, ChemoRT group that received concurrent RT and chemotherapy, T₁ start of radiotherapy, T₂ end of radiotherapy, T₃ 1 month after completion of radiotherapy, T₄ 6 months after completion of radiotherapy

Table 5 Comparison of scores for components of the EORTC QLQ-C30 questionnaire with patients categorized by radiation dose

Category	EORTC QLO-C30 Component	T ₁ (n=367)	T ₂ (n=366)	T ₃ (n=351)	T ₄ (n=316)	p (MANOVA)
Radiation dose	Physical functioning					
	<60 Gy	67±23	67±22	63±22	68±23	<0.001
	≥60 Gy	72±25	65±30	62±23	69±23	
	Role functioning					
	<60 Gy	70±29	69±29	73±27	76±27	0.006
	≥60 Gy	75±29	69±41	73±28	75±78	
	Emotional functioning					
	<60 Gy	69±22	70±24	75±23	80±21	<0.001
	≥60 Gy	75±22	71±23	77±22	82±21	
	Cognitive functioning					
	<60 Gy	74±23	77±20	78±24	82±22	<0.001
	≥60 Gy	77±20	78±20	81±20	83±20	
	Social functioning					
	<60 Gy	76±24	76±24	83±19	89±17	<0.001
	≥60 Gy	78±24	80±23	84±22	88±21	
	Fatigue					
	<60 Gy	35±23	35±22	29±22	22±23	<0.001
	≥60 Gy	29±22	35±24	29±23	23±21	
	Pain					
	<60 Gy	19±22	18±22	18±25	12±18	<0.001
≥60 Gy	18±23	24±24	17±21	17±25		
Insomnia						
<60 Gy	22±28	22±26	16±25	12±21	<0.001	
≥60 Gy	23±28	28±33	21±27	18±28		
Constipation						
<60 Gy	13±23	9±19	7±16	6±15	<0.001	
≥60 Gy	9±19	12±22	13±24	7±18		

Results are denoted as mean ± standard deviation

T₁ start of radiotherapy, T₂ end of radiotherapy, T₃ 1 month after completion of radiotherapy, T₄: 6 months after completion of radiotherapy

were with nausea/vomiting, diarrhea, and emotional functioning. We analyzed relationships between ECOG performance status and QOL in patients with a variety of cancer types, and our findings were similar to those of Guzelant et al [19]. ECOG performance status was associated with global health status, physical functioning, cognitive functioning, and role functioning on the EORTC QLQ-C30. For each of these scales, poorer ECOG performance status was associated with lower function. We observed no correlations between performance status and symptoms scores in our patient group.

It is logical to speculate that cancer patients with comorbidity who undergo RT would have poorer QOL than those without comorbidity. However, we found that fatigue score was only component of the EORTC QLQ-C30 for which there was a significant difference between these groups, with greater fatigue reported by patients with comorbidity.

Elumelu et al. [15] evaluated EORTC QLQ-C30 results according to disease stage in their patients with head and neck

cancer, and found that mean scores for global health status and all functional scales were significantly lower for late-stage (III and IV) patients than for early-stage (I and II) patients. They also observed that late-stage patients had significantly higher scores for all symptom scales/items than early-stage patients. McMillan et al. [20] used the EORTC QLQ C-30 to evaluate the relationship between QOL and survival in 152 patients with gastroesophageal cancer. They found that, compared to patients with early-stage disease, those in late stages had significantly poorer scores for global health status, social functioning, fatigue, and appetite loss. Our analysis revealed that disease stage had an effect on certain EORTC QLQ-C30 scores; specifically, patients with later-stage cancer had poorer mean scores for physical functioning, role functioning, and fatigue.

In the above-mentioned study that compared EORTC QLQ-C30 scores for rectal cancer patients who underwent preoperative RT or preoperative chemoRT, Tiv et al. [14]

observed that the chemoRT group had significantly lower scores for role functioning, social functioning, and global health status, whereas the RT group had a significantly higher score for diarrhea. Taphoorn et al. [21] evaluated the impact of chemoRT versus RT alone in patients with brain tumors and compared EORTC QLQ-C30 and BN-20 (a brain cancer module) scores at the start of RT, during RT, end of RT, and monthly thereafter during treatment until progression. During RT, they observed more side effects (nausea/vomiting, appetite loss, constipation) in the group of 248 patients treated with chemoRT than in the 242 patients treated with RT alone. In our analysis of cancer patients' EORTC QLQ-C30 scores, we found that chemoRT had an effect on physical functioning, fatigue, nausea/vomiting, and appetite loss. The group that received chemoRT had significantly poorer mean scores for these components. These findings were likely related to side effects of chemotherapeutic agents. However, we observed that QOL scores were unchanged in patients who received chemotherapy after radiotherapy. Because of small number of patients, we did not perform QOL assessments according to each tumor type.

Radiation dose in incidence of radiation-related side effects is an important parameter. Higher radiotherapy dose (≥ 60 Gy) had a negative effect on QOL scores such as physical functioning, role functioning, emotional functioning, fatigue, pain, insomnia, constipation. However, there was not a negative effect on the scores of cognitive functioning and social functioning.

Radiotherapy side effects are known to be associated with certain body sites of irradiation; thus, RT field is considered an important determinant of QOL [22]. In our study, at the end of RT, we observed the following: (i) the group irradiated in the abdomen had the highest mean score for nausea/vomiting; (ii) the groups irradiated in the abdomen and head/neck, respectively, had significantly higher mean scores for appetite loss than all other groups; (iii) the group irradiated in the pelvis had a significantly higher mean score for diarrhea than all other groups.

QOL scores gradually deteriorate during head-neck irradiation, and they improve over time after radiotherapy. These deteriorations may result in discontinuation of the treatment. Regularly QOL measurements of patients with cancer during their treatments may be beneficial in earlier detection of deterioration in QOL. Therefore, we strongly believe that physicians may improve QOL with supportive treatment and/or care. At the same time, QOL data may have value in daily practice. Routine QOL measurements of oncology patients visiting the outpatients department, with information provided to physicians, have been shown to have a positive effect on physician-patients communication. In some patients, these measurements improved QOL and emotional functioning [23]. Published studies that longitudinal measurements improve functional and symptom-related scores of QOL [24, 25].

Our study indicates that RT affects QOL negatively for patients with various forms of cancer, and that QOL improves significantly for these patients within the first 6 months after RT. We strongly believe that the very process of conducting QOL assessments can improve life quality for cancer patients. We suggest that QOL should be measured regularly in this group as part of routine patient management.

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