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A prospective follow-up of quality of life, depression, and anxiety in children with lymphoma and solid tumors

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Background/aim: The aim of this study was the determination and prospective follow-up of quality of life, depression, and anxiety in pediatric patients with cancer under chemotherapy, as well as the evaluation of related factors.

Materials and methods: Fifty newly diagnosed pediatric cancer patients and their parents were prospectively monitored before, during, and after therapy, and tests were used.

Results: Significantly lower quality of life scores were recorded during treatment, in the group with CNS tumors, in the group receiving chemotherapy plus radiotherapy plus surgery, in the inpatient-only treatment group, in the group receiving treatment for longer than 6 months, and in the group of patients whose diagnosis was delayed for more than 3 months. Total quality of life scores for children and their parents were 82.95 ± 14.59 vs. 83.61 ± 14.60 before, 54.69 ± 16.51 vs. 55.78 ± 16.05 during, and 83.88 ± 12.44 vs. 84.19 ± 13.22 at the end of treatment ($P < 0.05$). Anxiety and depression scores were significantly higher during treatment, in patients whose diagnoses were delayed for more than 3 months, and among inpatients.

Conclusion: The quality of life of a majority of our patients was severely affected, and depression and anxiety were more frequently seen especially during treatment.

Key words: Child, cancer, quality of life, depression, anxiety

1. Introduction

In recent years, assessments of quality of life and the psychological states of patients have become more important thanks to the increase in the lifespan of patients due to intensive and effective treatments applied for pediatric cancers (1–6).

In addition to disease-related complaints, children suffering from various types of cancer are exposed to many traumatic events during diagnostic processes, including invasive examinations and surgical applications. After establishment of the diagnosis, prominent physical adverse effects of chemotherapy and radiotherapy such as nausea, vomiting, loss of appetite, hair loss, mucositis, skin problems, pain, weakness, fatigue, symptoms of bone marrow depression, and infections can be seen. During treatment, the child is isolated from his/her school, friends, and family members. All these factors impair the

quality of life of the children and their families and induce psychological problems (7–13).

Although it is known that the quality of life of children with cancer is impaired and the severity of their anxiety and depression increases, only a small number of studies prospectively monitored these patients from the time of diagnosis and investigated fluctuations in their psychological health state (1–3). In the medical literature, quality of life, depression, and anxiety have been evaluated separately, and all these parameters have not been assessed in combination in the same patient group.

In this study, the aims were the determination and prospective follow-up of quality of life, depression, and anxiety in pediatric patients with cancer under chemotherapy; the comparison of pre-, intra-, and posttreatment assessments; and an evaluation of related factors.

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2. Materials and methods

This study was performed in the Division of Pediatric Oncology of the Faculty of Medicine with newly diagnosed pediatric cancer patients and their families. Patients aged 8–18 years who could comprehend the scales and directives to be used in this study were enrolled. Patients aged less than 8 and older than 18 years, previously treated patients still experiencing recurrences, those with motor or mental dysfunction who could not respond to questions on the questionnaire forms, patients who were monitored but did not receive treatment, and patients who could not complete their treatment were excluded from the study.

A total of 60 children were enrolled in the study. Ten patients who could not complete the study were excluded, and the study was finalized with 50 patients. Approval of the ethics committee was obtained (decree no: 2009 – 9 / 62). Informed consent forms were obtained from the patients and their families before their inclusion in the study.

The patients included in the study were prospectively monitored before and during the interval between the 2nd and 4th months of chemotherapy and also at least 3 months after therapy using a sociodemographic data form, the Children's Depression Inventory (CDI), the Screen for Child Anxiety Related Emotional Disorders (SCARED) - Child Version, and the Pediatric Quality of Life Inventory (PedsQL) for relevant evaluations. For parents of the participants, the parents' version of the Quality of Life Scale for Children was used.

The same physician conducted the questionnaire survey, and during the diagnosis, the participants were examined by a pediatric psychologist and a psychiatrist.

2.1. Questionnaire forms and scales applied

2.1.1. Sociodemographic data form

This form contains questions related to the sociodemographic data of the patients such as age, sex, family type, educational levels of the parents, their working status, monthly income of the family, psychiatric support (if any), adverse effects of chemotherapy, and information about their disease such as diagnosis, treatments applied, and duration of the treatment. This form was filled in by the researchers based on information gathered from the patient and his/her medical files.

2.1.2. Pediatric Quality of Life Inventory (PedsQL)

The PedsQL was developed by Varni et al. in 1999 to measure the health-related quality of life of children and adolescents aged between 2 and 18 years of age (14). The PedsQL has questionnaire forms for parents of the children aged 2–5 years and self-report forms prepared for pediatric/adolescent patients aged between 5 and 18 years. Although the questionnaire forms prepared for adolescents and children resemble each other, because of

the differences between cognitive developments of children and adolescents, simpler words are used for the pediatric questionnaire. The PedsQL consists of 23 domains. It inquires about the characteristics of healthiness as defined by the World Health Organization including physical health, emotional health, social functioning, and school functioning. Scoring is performed in three domains as the total score of the scale (TSS), total physical health score (PHTS), and total psychosocial health score (TPSS), including scores evaluating emotional, social, and school functions items. This scale inquires about the last month of the children and adolescents, and a Likert-type scale with 5 alternative responses for each question has been developed for children and adolescents aged between 8 and 18 years. Items are scored between 0 and 100 points. The total number of points is divided by the number of the items completely responded to in order to obtain the total score. As a consequence, a higher PedsQL total score signifies a better health-related quality of life. The validation and reliability of this scale were confirmed for Turkey (15,16).

2.1.3. Children's Depression Inventory (CDI)

The CDI contains 27 items aimed at defining the level of depression in children; a score of 19 points or more is indicative of depression (17,18).

2.1.4. Screen for Child Anxiety Related Emotional Disorders (SCARED)

The SCARED test contains 41 Likert-type questions, with a total score ranging from 0 to 82 points. Higher total scores indicate higher levels of anxiety (19).

2.2. Statistical analysis

Statistical analysis of data was performed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). Data were expressed as means \pm standard deviation. With the Kolmogorov–Smirnov test the assumption of normality could not be achieved. For time-related variables, percent changes were calculated. For intergroup comparisons the Kruskal–Wallis test and/or the Mann–Whitney U test and for intragroup comparisons the Wilcoxon test were employed.

For the comparison of categorical variables, the Pearson chi-square test and chi-square test with Yates correction and for the comparison of ratios the z-ratio test were used. To analyze relationships among variables, the Pearson correlation test was performed. $P < 0.05$ was accepted as the level of statistical significance.

3. Results

Fifty patients [mean age: 12.14 \pm 2.97 years; range: 8–17; males, $n = 30$ (60%)] with lymphoma and solid tumors were included in the study. Diagnosis was made within 3 months [$n = 31$ (62%)] or more than 3 months [$n = 19$ (38%)] after the onset of the disease. All patients received chemotherapy, while some patients received

radiotherapy (58%) and major surgery (36%). These treatments consisted of only chemotherapy [n = 13 (26%)], chemotherapy plus radiotherapy [n = 19 (38%)], surgery plus chemotherapy plus radiotherapy [n = 10 (20%)], or surgery plus chemotherapy [n = 8 (16%)] as received by the indicated number of patients. Patients' treatment was continued for less than [n = 24 (48%)] or longer than [n = 26 (52%)] 6 months (Table 1).

Mean quality of life scores calculated before, during, and after the treatment were 82.95 ± 14.59 , 54.69 ± 16.51 , and 83.88 ± 12.44 as assessed by the patients, respectively. Mean quality of life scores calculated before, during, and after the treatment were 83.61 ± 14.60 , 55.78 ± 16.05 , and 84.19 ± 13.22 as assessed by the parents, respectively. Scores obtained during treatment were statistically significantly lower than those calculated before and at the end of treatment ($P < 0.01$) (Table 2).

Mean quality of life scores estimated before the treatment using patients' and their parents' PedsQL scales differed statistically significantly between diagnostic groups ($P < 0.05$). In pairwise comparisons, the PedsQL scores of CNS tumors were significantly lower than those

of the lymphoma patients. When patients' and their parents' PedsQL total and subscale scores were compared, the lowest scores were estimated for the group receiving chemotherapy plus radiotherapy plus surgery.

Patients' and their parents' PedsQL total and physical and psychosocial health subscale scores were compared according to the location of health care services, and in all assessments, lower scores were obtained in the inpatient group relative to other groups. Percent changes in the social functioning subscale scores of the patients estimated during treatment were statistically significantly lower relative to pretreatment scores in patients receiving in-hospital treatment ($P < 0.05$). In all assessments, patients' and their parents' PedsQL total, physical, and psychosocial health subscale scores were comparatively lower in the group under treatment for longer than 6 months. PedsQL total, physical, and psychosocial health subscale scores of the patients and their parents were significantly lower in patients whose diagnoses were delayed for more than 3 months ($P < 0.05$) (Tables 3 and 4).

In all assessments, mean PedsQL scores of the patients and their parents were not statistically significantly

Table 1. Characteristics of the patients (n = 50).

Age [years, mean \pm SD (range)]	12.14 \pm 2.97 (8–17)
Sex [n, (%)]	
Female	20 (40)
Male	30 (60)
Diagnosis [n, (%)]	
Lymphoma	24 (48)
CNS tumors	7 (14)
Others	19 (38)
Time to diagnosis [n, (%)]	
0–3 months	31 (62)
>3 months	19 (38)
Treatments [n, (%)]	
Chemotherapy	13 (26)
Chemotherapy plus radiotherapy	19 (38)
Chemotherapy plus radiotherapy plus surgery	10 (20)
Chemotherapy plus surgery	8 (16)
Treatment type [n, (%)]	
Outpatient treatment	24 (48)
Inpatient treatment	15 (30)
Outpatient plus inpatient treatment	11 (22)
Duration of treatment [n, (%)]	
0–6 months	24 (48)
\geq 6 months	26 (52)

CNS, Central nervous system; SD, standard deviation.

Table 2. Quality of life scores.

	Pretreatment *	During treatment *	Posttreatment *	^a P	^b P	^c P
Patients' PedsQL scale						
Total score	82.95 ± 14.59	54.69 ± 16.51	83.88 ± 12.44	0.001	0.992	0.001
Physical health score	83.34 ± 17.29	48.51 ± 21.33	83.47 ± 18.03	0.001	0.734	0.001
Psychosocial health score	83.2 ± 13.92	59.22 ± 14.61	84.26 ± 10.58	0.001	0.775	0.001
Parents' PedsQL scale for children						
Total score	83.61 ± 14.60	55.78 ± 16.05	84.19 ± 13.22	0.001	0.907	0.001
Physical health score	84.57 ± 16.94	48.51 ± 21.33	83.47 ± 18.03	0.001	0.410	0.001
Psychosocial health score	83.19 ± 14.60	60.15 ± 14.75	84.55 ± 11.87	0.001	0.713	0.001

*Mean ± standard deviation; ^aP, for the comparison of the scores calculated during and before treatment; ^bP, for the comparison of the scores obtained before and at the end of treatment; ^cP, for the comparison of the scores obtained during and at the end of treatment.

different for sex, age of the patients, and educational level of their parents.

Mean anxiety and depression subscale scores were compared, and statistically significantly higher scores were detected during treatment relative to those estimated before and at the end of treatment ($P < 0.01$). Based on depression subscale scores, a significantly higher number of patients with depressive symptoms was detected during treatment when compared with before and at the end of treatment (36%, 18%, and 14%, respectively; $P < 0.05$) (Table 5).

Depression subscale scores of the patients were significantly higher when time to diagnosis was longer than 3 months ($P < 0.01$). Percent changes in depression scores calculated during treatment were statistically significantly different from those estimated before treatment ($P < 0.01$). Percent change in depression scores was significantly lower in patients whose time to diagnosis was longer than 3 months. The patients were compared according to diagnostic groups and their pretreatment depression scores were not significantly different. Percent change in depression scores calculated during treatment was statistically significantly different relative to pretreatment values ($P < 0.05$). Based on the results of pairwise comparisons, percent change in the depression scores calculated during treatment of lymphoma patients was significantly higher than that estimated for the CNS tumor group ($P < 0.05$). Percent changes calculated at the end of treatment were not statistically significantly different between these two groups (Table 6). The rate of depressive symptoms in inpatients and outpatients or those receiving treatment on both an inpatient and outpatient basis were respectively 16.7%, 20%, and 18.2% before treatment; 37.5%, 53.3%, and 9.1% during treatment; and 8.3%, 26.7%, and 9.1% at the end of the treatment.

Depression subscale scores of the children did not differ statistically significantly between sex and age groups.

A statistically significant and negative correlation was

detected between depression, anxiety scores, and physical health scores of the patients and their parents as assessed during treatment ($P < 0.01$, r coefficients: -0.693 , -0.650 , -0.525 , and -0.461 , respectively). A statistically significant and positive correlation was detected between depression and anxiety scores detected during treatment ($P < 0.01$, $r = 0.808$).

4. Discussion

In this study, when compared with other groups, quality of life scores were significantly lower during treatment and in the following groups: the CNS tumor group, the group receiving chemotherapy plus radiotherapy plus surgery, the group of patients receiving only inpatient treatment, the group treated for more than 6 months, and the group whose diagnosis was delayed for more than 3 months. Anxiety and depression scores were significantly higher during treatment in the group of patients whose diagnosis was delayed for more than 3 months and among inpatients. Quality of life scores, the presence of depression, and anxiety did not differ significantly with respect to sex, age, or the educational level of the parents.

In pediatric patients with cancer, quality of life decreases due to many factors including surgical interventions, radiotherapy, chemotherapy, adverse effects of the treatment, and prolonged hospitalization periods (20–26). Changes in the quality of life of the patients can reportedly decrease at 1 month of radiotherapy (14). In this study, significant decreases in the quality of life scores were detected during treatment. The lowest score was recorded in the physical health domain. These outcomes suggest that during treatment patients are more vulnerable to the impact of physical factors. Similarly, in many studies, authors have reported decreases in the quality of life scores during treatment, mostly in the physical health scores, and also indicated improvements in these scores after treatment (2,20).

Table 3. Comparison of quality of life scores of the patients according to diagnostic groups, treatments applied, type and duration of treatments, and time to diagnosis. Statistically significant values are shown in bold.

	Pretreatment*	During treatment*	Posttreatment*	^a P	^b P	^c P
Total score						
Diagnosis						
Lymphomas	88.27 ± 9.09	56.89 ± 16.43	87.38 ± 7.50	0.049	0.002	0.216
CNS tumors	71.25 ± 16.68	63.54 ± 15.14	79.92 ± 21.24			
Others	80.52 ± 16.86	48.64 ± 15.65	80.90 ± 12.92			
Treatments applied						
CT	89.26 ± 8.47	51.46 ± 18.05	87.32 ± 7.22	0.062	0.338	0.418
CT plus RT	84.04 ± 11.66	58.63 ± 14.68	86.43 ± 8.52			
CT plus RT plus S	68.31 ± 20.41	48.47 ± 15.48	74.19 ± 19.94			
CT plus S	88.40 ± 8.10	58.36 ± 18.84	84.32 ± 11.05			
Treatment type						
Outpatient treatment	84.64 ± 11.53	57.65 ± 16.75	86.80 ± 9.25	0.216	0.855	0.444
Inpatient treatment	80.82 ± 19.09	48.16 ± 15.72	79.01 ± 18.41			
Outpatient plus inpatient	82.16 ± 14.61	57.12 ± 15.91	84.14 ± 5.53			
Time to diagnosis						
0-3 months	88.60 ± 10.96	53.94 ± 17.32	86.45 ± 8.80	0.001	0.011	0.027
≥ 3 months	73.73 ± 15.33	55.91 ± 15.48	79.67 ± 16.19			
Duration of treatment						
0-6 months	87.72 ± 10.88	56.65 ± 17.31	85.57 ± 13.94	0.056	0.627	0.089
≥6 months	78.53 ± 16.32	52.88 ± 15.86	82.31 ± 10.91			
Physical health score						
Diagnosis				0.270	0.069	0.372
Lymphomas	87.98 ± 11.55	54.74 ± 18.48	89.02 ± 9.49			
CNS tumors	77.22 ± 16.01	55.77 ± 21.76	75.87 ± 28.78			
Others	79.74 ± 22.39	37.97 ± 21.34	79.25 ± 20.30			
Treatments applied						
CT	89.41 ± 10.86	48.04 ± 21.34	89.63 ± 8.68	0.189	0.516	0.281
CT plus RT	82.02 ± 15.55	52.71 ± 21.95	87.46 ± 11.02			
CT plus RT plus S	71.87 ± 26.19	39.35 ± 19.75	68.09 ± 30.47			
CT plus S	90.98 ± 7.74	50.76 ± 22.14	83.17 ± 13.78			
Treatment type						
Outpatient treatment	85.25 ± 12.86	51.10 ± 23.27	87.33 ± 11.30	0.147	0.437	0.644
Inpatient treatment	78.94 ± 23.09	43.10 ± 18.55	78.09 ± 28.74			
Outpatient plus inpatient	85.20 ± 17.23	50.24 ± 20.97	82.37 ± 7.93			
Time to diagnosis						
0-3 months	89.79 ± 13.84	47.64 ± 22.57	87.98 ± 10.68	0.001	0.084	0.004
≥3 months	72.82 ± 17.51	49.93 ± 19.66	76.11 ± 24.56			
Duration of treatment						
0-6 months	87.07 ± 13.5	52.45 ± 21.77	85.57 ± 13.94	0.255	0.503	0.727
≥6 months	79.90 ± 20.10	44.90 ± 20.68	82.31 ± 10.91			
Psychosocial health score						
Diagnosis				0.018	0.001	0.015
Lymphomas	88.72 ± 8.48	58.86 ± 15.72	86.68 ± 7.86			
CNS tumors	67.25 ± 18.17	69.28 ± 12.39	82.60 ± 16.28			
Others	82.15 ± 13.60	55.95 ± 12.80	81.81 ± 11.04			

Table 3. (Continued).

Treatments applied						
CT	89.57 ± 8.98	54.03 ± 17.43	86.39 ± 7.74			
CT plus RT	85.32 ± 10.07	62.16 ± 12.01	85.90 ± 9.59			
CT plus RT plus S	66.91 ± 17.75	56.91 ± 12.82	77.80 ± 13.95	0.008	0.057	0.128
CT plus S	88.30 ± 7.47	63.53 ± 17.02	84.97 ± 10.83			
Treatment type						
Outpatient treatment	84.96 ± 11.49	61.46 ± 14.56	86.68 ± 9.45			
Inpatient treatment	82.74 ± 16.30	53.16 ± 15.10	79.75 ± 13.60	0.215	0.353	0.305
Outpatient plus inpatient	80.06 ± 15.98	62.57 ± 12.66	85.11 ± 6.20			
Time to diagnosis						
0–3 months	88.43 ± 9.14	58.35 ± 15.42	85.78 ± 8.78			
≥3 months	74.71 ± 16.27	60.63 ± 13.48	81.77 ± 12.87	0.003	0.011	0.008
Duration of treatment						
0–6 months	88.36 ± 10.62	60.25 ± 15.54	86.00 ± 11.82			
≥6 months	78.47 ± 15.07	58.26 ± 13.95	82.65 ± 9.22	0.011	0.286	0.071

*Mean ± standard deviation; CT, chemotherapy; RT, radiotherapy; S, surgery; CNS, central nervous system; ^aP, for the comparison of pretreatment values; ^bP, intergroup comparisons of percent changes calculated during treatment relative to pretreatment values; ^cP, intergroup comparisons of percent changes calculated at the end of treatment relative to pretreatment values.

In the literature, lower quality of life scores have been reported for patients with CNS tumors whose treatment was completed relative to lymphoma and other cancer patients (27–32). Eiser et al. (30) reported unfavorable quality of life scores in adolescent CNS cancer patients whose treatment was completed when compared with ALL patients, most prominently observed in the physical and psychosocial subscale scores. In this study, lower quality of life scores in patients with CNS were detected, comparable to the study outcomes reported by Meeske et al. (31) and Chou et al. (32). This result is associated with the location of the tumor and neurocognitive changes caused by surgery and radiotherapy. It reduces the reliability of our results because CNS tumors existed in only a small proportion of the patients. Therefore, these results should be confirmed in larger patient series.

In this study, we have observed that in the patient group for which all three treatment modalities (chemotherapy plus radiotherapy plus surgery) were used, quality of life scores were lower in evaluations. In this group, during pretreatment evaluations, lower quality of life scores and statistically significantly decreased psychosocial health scores were detected. This may be explained by the evaluation of some patients after application of surgical treatment, and the awareness of the patients and their parents about other treatment modalities to be applied. Psychosocial effects of treatment begin to be influential long before the initiation of the medical treatment. Lower quality of life during and after treatment is related to the increase in side effects seen in parallel with an increase

in treatment modalities. Magal-Vardi et al. (33) found a correlation between disease severity and quality of life scores in children with cancer. Landolt et al. (2) reported that more intensive treatment 6 weeks after diagnosis and treatment-related complications affected quality of life. Similar to our study, a higher number of physical symptoms, greater deterioration of motor functioning, and marked decrease in emotional functioning were observed with more intensive treatment. In another study the stage of the cancer and treatment protocol to be followed were found to be significantly effective on the quality of life. Unfavorable effects of additional surgery, intensive chemotherapy, and hospitalizations on quality of life were also detected (34).

In some studies, differences between the quality of life of hospitalized patients and those receiving ambulatory chemotherapy were reported (35,36). In this study, though not statistically significant, in patients receiving therapy while hospitalized lower quality of life scores were detected when compared with other groups. Studies performed demonstrated that children receiving outpatient chemotherapy had higher quality of life scores relative to inpatients under chemotherapy (37).

In this study, quality of life scores in patients receiving treatment for longer than 6 months were lower in all evaluations. Though lower quality of life scores in patients treated for prolonged periods is to be expected, we investigated the factors related to the unexpectedly lower pretreatment scores. When all factors were analyzed, delays in diagnosis attracted our attention. In 54% of the

Table 4. Comparison of quality of life scores of the parents' scale for children according to diagnostic groups, treatments applied, type and duration of treatments, and time to diagnosis. Statistically significant values are shown in bold.

	Pretreatment*	During treatment*	Posttreatment*	^a p	^b p	^c p
Total score						
Diagnosis						
Lymphomas	89.10 ± 8.49	58.37 ± 17.41	87.19 ± 8.57	0.048	0.003	0.225
CNS tumors	71.81 ± 17.81	64.37 ± 14.87	79.60 ± 22.20			
Others	81.04 ± 16.76	49.33 ± 12.58	82.10 ± 13.88			
Treatments applied						
CT	89.73 ± 6.71	54.84 ± 18.57	86.11 ± 7.68			
CT plus RT	84.83 ± 12.56	56.46 ± 14.43	87.64 ± 8.66	0.009	0.466	0.140
CT plus RT plus S	67.12 ± 18.70	50.19 ± 13.50	74.30 ± 20.47			
CT plus S	91.40 ± 5.26	62.66 ± 18.44	85.27 ± 14.48			
Treatment type						
Outpatient treatment	86.19 ± 10.89	58.82 ± 16.31	88.12 ± 9.17	0.931	0.467	0.789
Inpatient treatment	81.89 ± 18.97	49.77 ± 14.55	78.39 ± 18.89			
Outpatient + inpatient	80.34 ± 15.33	57.32 ± 16.58	83.54 ± 8.67			
Time to diagnosis						
0–3 months	89.02 ± 10.01	54.48 ± 17.24	86.51 ± 9.95	0.001	0.004	0.047
≥3 months	74.78 ± 16.74	57.89 ± 14.06	80.42 ± 16.92			
Duration of treatment						
0–6 months	88.87 ± 10.28	57.57 ± 18.14	85.48 ± 13.69	0.013	0.554	0.028
≥6 months	78.76 ± 16.42	54.12 ± 14.00	83.01 ± 12.92			
Physical health scores						
Diagnosis	89.88 ± 10.40	54.66 ± 20.31	88.75 ± 9.17	0.182	0.886	0.081
Lymphomas	78.54 ± 16.38	56.20 ± 23.49	73.20 ± 29.62			
CNS tumors	80.07 ± 21.92	38.77 ± 19.57	80.88 ± 21.02			
Others						
Treatments applied						
CT	91.02 ± 10.56	50.93 ± 20.85	88.90 ± 8.15			
CT plus RT	84.31 ± 16.45	48.81 ± 21.46	88.43 ± 9.99	0.104	0.944	0.175
CT plus RT plus S	71.54 ± 23.44	39.02 ± 19.70	66.53 ± 30.33			
CT plus S	90.98 ± 6.98	57.77 ± 24.37	84.73 ± 17.25			
Treatment type						
Outpatient treatment	87.05 ± 12.02	52.05 ± 23.56	87.85 ± 10.48	0.748	0.292	0.583
Inpatient treatment	80.97 ± 22.60	42.49 ± 17.49	76.82 ± 29.31			
Outpatient + inpatient	84.06 ± 18.02	50.48 ± 22.11	83.49 ± 10.08			
Diagnosis duration						
0–3 months	90.47 ± 11.30	46.96 ± 22.12	88.36 ± 10.99	0.002	0.048	0.786
≥3 months	74.93 ± 20.26	51.90 ± 20.88	75.78 ± 24.95			
Treatment duration						
0–6 months	88.70 ± 11.91	52.30 ± 22.22	84.97 ± 18.38	0.218	0.620	0.198
≥6 months	80.75 ± 20.01	45.64 ± 20.89	82.30 ± 18.80			
Psychosocial health scores						
Diagnosis	88.86 ± 9.15	60.11 ± 17.51	86.34 ± 9.84	0.022	0.001	0.063
Lymphomas	67.25 ± 19.71	68.80 ± 12.78	82.37 ± 18.10			
CNS tumors	81.91 ± 14.16	57.01 ± 10.34	83.10 ± 11.92			
Others						

Table 4. (Continued).

Treatments						
CT	89.33 ± 6.51	57.55 ± 18.89	84.57 ± 9.89			
CT plus + RT	85.15 ± 11.80	59.87 ± 12.74	87.38 ± 9.63	0.001	0.030	0.025
CT plus RT plus S	64.40 ± 16.88	57.75 ± 11.51	78.64 ± 15.93			
CT plus S	92.06 ± 4.52	68.01 ± 15.25	85.20 ± 13.46			
Treatment type						
Outpatient treatment	85.85 ± 11.48	62.46 ± 14.54	88.20 ± 9.70	0.583	0.424	0.259
Inpatient treatment	82.86 ± 17.39	55.50 ± 15.50	79.53 ± 14.78			
Outpatient plus inpatient	77.85 ± 16.43	61.43 ± 14.03	83.45 ± 9.84			
Time to diagnosis						
0–3 months	88.41 ± 10.38	58.75 ± 16.21	85.77 ± 10.37	0.004	0.004	0.040
≥3 months	74.68 ± 16.66	63.43 ± 12.07	82.57 ± 14.05			
Duration of treatment						
0–6 months	89.14 ± 10.52	61.05 ± 16.98	85.86 ± 12.11	0.005	0.118	0.030
≥6 months	77.70 ± 15.83	59.31 ± 12.65	83.35 ± 11.75			

*Mean ± standard deviation; CT, chemotherapy; RT, radiotherapy; S, surgery; CNS, central nervous system; ^aP, for the comparison of pretreatment values; ^bP, intergroup comparisons of percent changes calculated during treatment relative to pretreatment values; ^cP, intergroup comparisons of percent changes calculated at the end of treatment relative to pretreatment values.

Table 5. Results of the depression and anxiety scale scores of the patients. Statistically significant values are shown in bold.

	Pretreatment*	During treatment*	Posttreatment*	^a P	^b P	^c P
Anxiety score	16.68 ± 12.01	25.42 ± 12.37	16.82 ± 8.46	0.001	0.856	0.001
Depression score	8.06 ± 7.35	15.58 ± 7.60	8,82 ± 6.96	0.001	0.444	0.001

*Mean ± standard deviation; ^aP, for the comparison of the scores calculated during and before treatment; ^bP, for the comparison of the scores obtained before and at the end of treatment; ^cP, for the comparison of the scores obtained during and at the end of treatment.

patients receiving treatment for more than 6 months, and in 21% of those under treatment for 0–6 months, diagnosis was delayed for more than 3 months. In this study, in patients whose diagnosis was delayed for more than 3 months, lower quality of life scores were detected. In half of the patients who were treated for more than 6 months, we thought that delay in diagnosis for more than 3 months was associated with lower pretreatment PedsQL scores.

Higher incidence rates of depression were reported in cancer patients secondary to side effects of chemotherapy or intractable symptoms of the disease per se. Many clinicians consider depressive complaints in cancer patients as normal concomitant symptoms and do not request psychiatric evaluations. In a study conducted among cancer patients from 34 centers in England concerning psychiatric symptoms, a difference of 34.7% was detected

between patients' and physicians' quality of life scores. Based on the outcomes of this study, psychiatric symptoms of the patients were overlooked and left untreated (38).

In this study, depressive symptoms were detected before (18%), during (36%), and after (14%) treatment in the respective percentages of patients. Incidence rates of depressive disorders were also reported in school-aged children (2%) and adolescents (15%) (39–41). In pediatric patients with cancer the incidence of depression and anxiety ranges between 7% and 53% (33, 42–47).

In this study, the depression and anxiety scores calculated during treatment were significantly higher than those detected before and at the end of the treatment. Higher depression and anxiety scores during treatment are associated with many factors including tumoral effects, hospitalization, treatments applied, and their adverse effects.

Table 6. Intergroup comparisons of depression scales applied for patients. Statistically significant values are shown in bold.

	Pretreatment*	During treatment*	Posttreatment*	^a P	^b P	^c P
Depression score						
Lymphoma	5.58 ± 4.29	15.04 ± 7.78	7.08 ± 5.03	0.074	0.025	0.373
CNS tumors	14.43 ± 8.63	12.86 ± 5.08	9.29 ± 10.54			
Others	8.84 ± 8.60	17.26 ± 8.06	10.84 ± 7.35			
Depression score						
Time to diagnosis of <3 months	5.45 ± 4.84	15.87 ± 7.90	7.87 ± 5.96	0.007	0.001	0.090
Time to diagnosis of ≥3 months	12.32 ± 8.78	15.11 ± 7.27	10.37 ± 8.28			

*Mean ± standard deviation; CNS, central nervous system; ^aP, for the comparison of pretreatment values; ^bP, intergroup comparisons of percent changes calculated during treatment relative to pretreatment values; ^cP, intergroup comparisons of percent changes calculated at the end of treatment relative to pretreatment values.

In this study, depression scores were significantly higher in patients whose diagnosis was delayed for more than 3 months. Percent changes in scores recorded during treatment were significantly higher than pretreatment scores in patients whose diagnosis was established within 3 months after disease onset. These results have revealed that lower pretreatment depression scores in patients whose diagnosis was established within a short time increased during the treatment process, and depression was observed in a higher percentage of patients while they were under treatment.

In this study, among groups of patients treated on an outpatient, inpatient, and both out- and inpatient basis, comparable percentages of patients had depressive symptoms before treatment. However, during and at the end of treatment, a higher percentage of inpatients had depressive symptoms when compared with the other groups. Because of the limited sampling size, statistical comparisons could not be made. However, social functioning subscale scores were lower in inpatients during the treatment process. We presumed that depression scores might be higher in association with these increased social functioning scores. In many studies, no marked difference was detected between patients treated on an outpatient or inpatient basis for the development of psychological disorders. Though presumably children treated on an outpatient basis carry lower risk regarding psychiatric diseases, chemotherapy and radiotherapy exert many unfavorable adverse effects on the psychological health state of children. In children receiving outpatient treatment, stressors such as school absence, separation from their friends because of risk of infection, and physical complaints related to the adverse effects of chemotherapy

(fatigue, weakness, nausea and vomiting, etc.) contribute to the development of psychological disorders (43,44).

In this study, though not statistically significant, pretreatment depression scores were higher in the CNS tumor group. However, during treatment, the percent change in the depression scores was significantly higher in the lymphoma group relative to the CNS tumor group. We think that higher pretreatment depression scores in the CNS cancer patients might be the reason for detecting higher depression scores in this group during treatment. Higher pretreatment depression scores were consistent with lower quality of life scores.

The strong points of this study include the evaluation of the patients at the time of diagnosis and, with prospective monitorization, reevaluation of the patients during and after treatment so as to compare quality of life scale scores. Quality of life, depression, and anxiety were evaluated in combination and related factors were analyzed. Among its limitations, the small number of patients, lack of a control group, and determination of the lowest age limit of the patients as 8 years of age can be mentioned.

In conclusion, this study was conducted mostly in the pediatric age group among patients who received intensive therapy, and the patients were prospectively followed. In the majority of the patients, especially during treatment, quality of life was seriously affected and depression and anxiety were encountered at an increased incidence. Although improvement in these rates was observed after treatment, these patients should be followed for a long-term period as regards quality of life, depression, and anxiety. As far as we know, no other study has evaluated quality of life, depression, and anxiety in combination and followed them prospectively in the same patient group.

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