Research Journal of Biological Sciences 2 (5): 551-556, 2007

Incidence of Eating Problems, Taste Changes and Food Preference of Cancer Patients During Radiotherapy

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Abstract: Radiotherapy can be an important component of cancer treatment for cure, prolongation of life or pain control; however, it has clinical limitations due to its adverse effects, mainly damage to normal tissues. The side-effects of cancer treatment further compromise nutritional status. There are few reports about the incidence of eating problem during radiotherapy. Considering the importance of symptoms on quality of life and nutritional status, the present study was conducted to determine the occurrence of eating problems, food preferences on body weight and dietary intake for patients with cancer treated with radiotherapy during treatment. During the period of October to March 2005, 61 (38 males and 23 females) volunteers cancer patients with mean age of 53±16 years who referred to the radiotherapy center of Imam Khomeini hospital were recruited. Changes of mouth dryness, appetite loss, nausea, hypoguesia, dysphagia,..., taste changes and food preferences were determined by questionnaire before and during radiotherapy. Changes in dietary intake (using 24 h recall method) and body weight were evaluated prior to and during radiotherapy. Incidence of anorexia, dry mouth, mouth sores, hyposmia, hypoguesia, dysphagia increased significantly during radiotherapy ($p<0.05$). Patients didn't tend to eat hard food and high animal protein food (meat and liver) more frequently as RT progressed especially during the first 3 weeks of treatment. Incidence of bitter taste in the mouth of patients increased during radiotherapy. In our study eating problem affected weight loss and dietary intake significantly ($p = 0.007$, $\beta = 0.452$ and $p = 0.001$, $\beta = 0.563$). Because of the negative effect of radiotherapy on oral feeding, daily assessment of side -effects, symptom support and nutritional advice adjusted to the individual patient are parts of adequate nutritional care.

Key words: Radiotherapy, eating problem, food preferences, taste changes

INTRODUCTION

Patients with cancer may suffer from a variety of symptoms involving the distress associated with the symptom (Cooley, 2000). Patients with cancer especially gastrointestinal, head and neck cancer already have a compromised nutritional status at the time of diagnosis, before treatment has started because tumors alter chewing and swallowing ability or because the host response to the tumor (causing anorexia and altered metabolism) (Huhmann and Cunningham, 2005). The side -effects of cancer treatment further compromise nutritional status (Huhmann and Cunningham, 2005). The effects of these treatments vary according to regimen and individual response (Huhmann and Cunningham, 2005). Radiotherapy can be an important component of cancer treatment for cure, prolongation of life or pain control (Porock, 2002) however, it has clinical limitations due to its adverse effects, mainly damage to normal tissues (Pia *et al*., 2001). Gastrointestinal tract, head and neck cancer patients being treated with radiotherapy are at an increased risk of malnutrition due to the severe side effects.

A review by Maranzano (2001) showed that patients submitted to abdominal radiotherapy are at major risk of developing vomiting and nausea (71%). Shi *et al*. (2004) found in their study that subjective taste impairment, appetite loss and satisfaction with current state tended to deteriorate significantly during radiotherapy. Christman *et al*. (2001) found diarrhea was prevalent by the second week of treatment with radiotherapy for patients with cervical or uterine cancer.

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Moreover, cancer -associated malnutrition has many consequences, including increased risk of complications, decreased response and tolerance to treatment, a lower quality of life, reduced survival and higher health care costs (Nitenberg and Raynard, 2000; Oterry, 1996; Langer *et al*., 2001).

A number of small descriptive studies have examined characteristics of individual symptoms associated with radiotherapy. The majority of these studies have focused on fatigue (Sadler and Jacobson, 2001; Monga *et al*., 1999; Greenberg *et al*., 1992). Many reports have been limited to patients being treated for one specific cancer diagnosis (Bansal *et al*., 2004; Schumacher *et al*., 2004). Some reports have assessed symptoms only before the initiation of RT and at one or more time points after RT had been concluded but have not followed the change in frequency or severity of symptoms during the course of treatment.

Considering the importance of symptoms on quality of life and nutritional status, the present study was conducted to determine the occurrence of eating problems, food preference on body weight and dietary intake for patients with cancer treated with radiotherapy during treatment.

MATERIALS AND METHODS

This prospective study was approved by Ethics Committee of Tabriz University of Medical Sciences. During the period of October to March 2005, 61 (38 males and 23 females) volunteers cancer patients with mean age of 53±16 years who referred to the radiotherapy center of Imam Khomeini hospital were recruited. Before radiotherapy planning, radiation-oncologist registered patients´ clinical variable, cancer location and TNM (tumor size, nodes, metastasis) staging. Patients on the basis of location of radiotherapy classified to: Mediastinum, head and neck, pelvic and Chest wall. Therapy was performed as 1.8 or 200 gray (Gy) day^{-1}, 5 days a week for 6 weeks.

Study measures: Each patient was asked to response to a questionnaire dealing with subjective awareness of mouth dryness, taste change, dysphagia, appetite loss, nausea, vomiting, mouth sores and constipation, diarrhea and food preferences. The questionnaire was read to the subject by the nutritionist and any ambiguous responses were clarified by further questioning. Patients were interviewed and the questionnaire completed prior to the starts of radiotherapy and at weekly intervals for 6 weeks during radiotherapy.

A prior to and during radiotherapy, single nutritionist assessed nutritional status as described below:

Height was measured using a mounted tape with the subject arm hanging freely at their sides and recorded to the nearest 0.5 cm.

Body weight of subjects were measured bare foot and light clothing to the nearest 0.1 kg with a Seca scale. Weight measurements in patients were before and up to six weeks of therapy.

Dietary intake was assessed by using a 24-h recall food questionnaire for three days of week which was taken from patients prior to and during radiotherapy and were analyzed for energy, protein intake by using Nutrition III for Windows Soft-ware.

Before completing the questionnaire the reliability analysis was performed to determine the extent to which items in the questionnaire were related to each other. The scale reliability was estimated with Cronbache´s alpha coefficient. The Cronbachs reliability coefficient was 0.844 which showed that the items were highly correlated.

Descriptive statistics were obtained for all study variables for each study group. The comparison of body weight, energy and protein intake during the treatment was analyzed by repeated measures ANOVA and for symptoms cohran´s Q test. Multivariate logistic regression analysis was done to identify variables that influence weight loss and dietary intake. A P-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 shows the number of patients presenting symptoms prior to and during radiotherapy in cancer patients. Incidence of anorexia, dry mouth, mouth sores, hyposmia, hypoguesia and dysphagia increased significantly during radiotherapy ($p<0.05$). In our study, we observed incidence of symptoms such as nausea, dry mouth, hypoguesia, hyposmia, dysphagia and constipation increased by the 55 week of RT. Only vomiting improved during RT, but changes wasn't significant.

Table 2 lists the foods most often mentioned as tasting unusual. Patients don't tended to eat hard food and high animal protein food (meat and liver) more frequently as RT progressed especially during the first 3 weeks of treatment.

Changes in taste of patients during RT was presented in Table 3. The results of our study showed that incidence of bitter taste in the mouth of patients increased during radiotherapy.

Table 1: Change in incidence of symptoms before and during of radiotherapy

	Before		1st week		2nd week		3rd week		4th week		5th week		6th week§		
Symptoms	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	PV*
Appetite Loss	22	36.1	25	41	25	41	34	55.7	30	49.2	30	49.2	32	52.5	0.04
Nausea	15	24.6	22	36.1	26	42.6	22	36.1	21	34.4	20	32.8	17	27.9	0.08
Dry mouth	28	45.9	38	62.3	40	65.6	38	62.3	40	65.6	39	63.9	39	63.9	0.001
Vomiting	12	19.7	14	23	10	16.3	8	13.1	8	13.1	8	13.1	7	11.5	0.17
Diarrhea	4	6.6	2	3.3	7	11.5	1	1.6	1	1.6	5	8.2	4	6.6	0.09
Mouth sores	8	13.1	6	9.8	16	26.2	12	19.7	9	14.8	8	13.1	9	14.8	0.01
Constipation	20	32.8	26	42.6	23	37.7	24	39.3	31	50.8	26	42.6	26	42.6	0.21
Dysgusia	16	26.2	18	29.5	20	32.8	22	36.1	23	37.7	25	41	24	39.3	0.006
Hyposmia	6	9.8	13	21.3	18	29.5	19	31.1	18	29.5	21	34.4	20	32.8	0.001
Dysphagia	17	27.9	19	31.1	23	37.7	26	42.6	25	41	28	45.9	26	42.6	0.03

§ the end of treatment, *PV cochran´ Q test

Table 2: Changes in eating habits of patients during radiotherapy

	Before		1st week		2nd week		3rd week		4th week		5th week		6th week§	
Food groups	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Hard foods	13	21.3	13	19.7	12	19.6	11	18.0	10	16.3	9	14.7	8	13.1
High fats-fried foods	2	3.3	1	1.6	1	1.6	15	21.8	-	-	-	-	-	-
High protein foods-meat, liver	4	6.6	7	11.5	6	9.8	18	29.5	4	6.5	3	4.9	6	9.8
High fats/protein foods	1	1.6	1	1.6	1	1.6	-	-	1	1.6	2	3.2	2	3.2
Citrus fruits, juices, tea	-	-	1	1.6	-	-	-	-	-	-	-	-	-	-
Sweet	1	1.6	-	-	-	-	-	-	1	1.6	-	-	-	-

N = Number of patients, Remaining patients didn't complain of abnormal tasting food, § the end of treatmen

Table 3: Changes of taste in mouth of patients during radiotherapy

	Before		1st week		2nd week		3rd week		4th week		5th week		6th week§	
Abnormal taste in mouth	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Bitter	7	11.5	29	47.5	34	55.7	36	59	37	60.7	36	59	38	62
Metal	-	-	-	-	-	-	-	-	-	-	2	3.3	2	3.3
No taste at all	52	85.2	31	50.8	27	44.3	25	41	24	39.3	23	37.7	21	34.4
Unpleasant	2	3.2	1	1.6	-	-	-	-	-	-	-	-	-	-

§the end of treatment

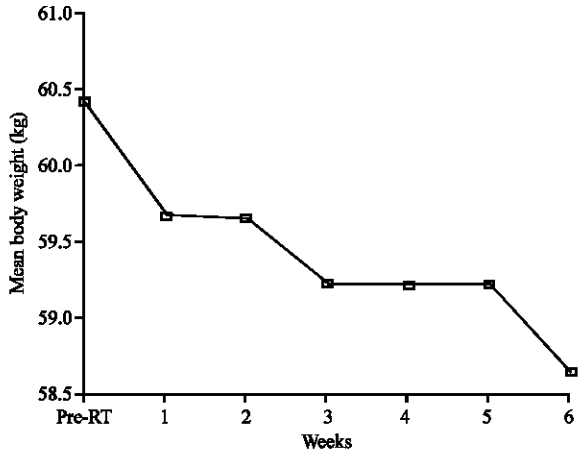

Fig. 1: Changes in body weight of subjects during therapy. Change from start to end of radiotherapy, repeated measures ANOVA, *p=0.001

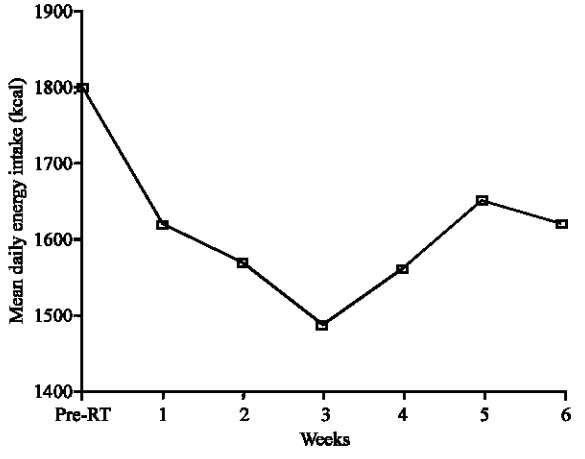

Fig. 2: Changes in daily mean energy intake during therapy. Change from start to end of radiotherapy

The changes in weight experienced by the patients during RT were shown in Fig. 1. A significant weight loss was observed during therapy (p = 0.001). The most weight loss experienced by the patients at the 1st, 3rd and 6th week of therapy. The mean daily energy and protein

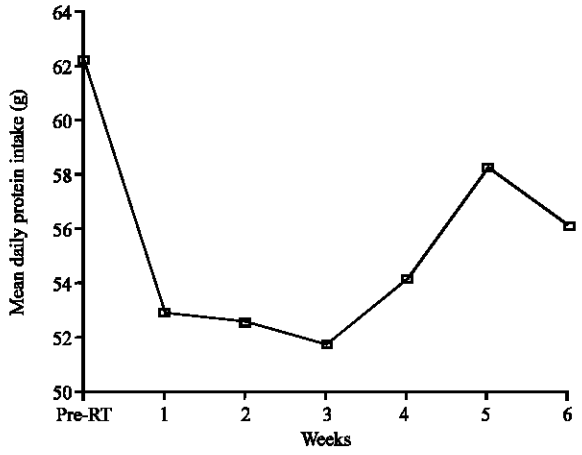

Fig. 3: Changes in daily mean protein intake during therapy. Change from start to end of radiotherapy

intake of patients prior to and during radio therapy are shown in Fig. 2 and 3. The mean energy intake decreased during therapy which reduction of energy intake was observed especially during the first three weeks of therapy. Changes in protein intake, during therapy were similar to changes of the mean energy intake. In our study eating problem affected weight loss and dietary intake significantly ($p = 0.007$, $\beta = 0.452$ and $p = 0.001$, $\beta = 0.563$).

DISCUSSION

Quality of life is an outcome that is especially important for patients with cancer. Nutritional status has an important effect on quality of life and sense of wellbeing in patients with cancer. Patients who report difficulty eating, because of side -effects or their disease, often avoid social interaction with family and friends, resulting in further depression of appetite (McGrath, 2002). Specific factors such as mouth pain, avoidance of eating in public and unclear speech, have been associated with poorer overall quality of life in patients with cancer (McGrath, 2002).

Radiotherapy is toxic to tumors cells and normal host cells within the area of treatment. As with chemotherapy, rapidly dividing tissues cells, such as blood cells, hair follicles and cells lining the gastrointestinal tract, are the most susceptible to radiation damage (Bloch, 2003). Therefore, any treatment directed at the gastrointestinal tract is likely to result in nutrition problems (Capra *et al*., 2001).

In present study, the patients´ loss of appetite, dry mouth, mouth sores, hypoguesia and hyposmia increased significantly during radiotherapy (Table 1).

Findings of our study were in agreement with previous studies that reported significant anorexia, nausea, dry mouth and mouth sores in patients following radiotherapy (Dias *et al*., 1996; Ripamoni *et al*., 1996; Burlage *et al*., 2001; Horiot and Aparo, 2004; Ahlberg *et al*., 2005).

The results of our study support the observations of previous investigators that many patients receiving radiotherapy experience hypoguesia during treatment (Mossmand and Henkin, 1978; Shi *et al*., 2004). Mossmank and Henkin (1978) observed impairment of taste approximately 2 weeks after initiation of radiotherapy (Mossmand and Henkin, 1978).

Maes noted during and after radio therapy, subjective complaints of taste impairment. Shi *et al*. (2004) reported subjective taste impairment tended to deteriorate significantly during radiotherapy.

The taste change experienced by many patients especially head and neck cancer during radiotherapy may be the most serious consequences of treatment (Table 1). Meat and high protein foods consumption in patients were especially found to be abnormal tasting by the patients in the present study (Table 2). It may be a consequence of radiation therapy directed to the head and neck can cause severe taste changes due to cell damage (Ripamonti *et al*., 1998; Lees, 1999; Vissink *et al*., 2003a). These effects are primarily due to the direct toxic effect of radiation on the cells of the tongue, microvilli and taste buds and or their innervating nerve fibers. In addition salvia production may be irreversibly reduced or impaired by radiation therapy, resulting in altered taste sensation and altered perception of food texture, plus difficulty in physically chewing foods due to lack of salvia (Fang *et al*., 2002; Vissink *et al*., 2003b). Alterations in patients´perception of sweet, salt, bitter and acid are variable and range from mild changes to almost complete absence (Grant and Kravits, 2000). Individual nutrient deficits have also been linked to impaired taste. For example, zinc deficiency has been suggested to impair taste sensation (Nitenberg and Raynard, 2000). Taste alterations can lead to the development of food aversions, a reduction in food intake (Grant and Kravits, 2000) and ultimately nutritional deficits. Aversion to food high in protein, particularly red meats and cereals, have been observed (Holmes,1993). Avoidance of meat, tea, citrus fruit and chocolate was associated with increased sensitivity to bitter taste which were agreement with our results.

Dysphagia can occur before radiotherapy due to intrinsic or extrinsic tumor compression in patients with esophagus, head and neck cancer (Capra *et al*., 2001) and

radiotherapy treatment to the pharynx and esophagus for long periods can result in inflammation, loss of superficial epithelium, sub mucosa deem, stenosis, ulceration and perforation (Bloch, 2003; Elderige, 2004; Bussman, 2004). All of these have a significant effect on dietary intake which can lead to dysphagia which was in agreement with our results.

In our study, incidence of diarrhea, vomiting and constipation didn't change significantly during radiotherapy. We thought that insignificant changes of incidence of theses symptom may be due to small sample size.

According to our findings the most dramatic increase in incidence of symptoms (anorexia, dry mouth, ….) had already worsened by the 3rd week of radiotherapy, suggesting that early intervention with mitigating therapies may be beneficial for patients. Protocols aimed at prevention of symptoms should begin the intervention at the time radiation is initiated.

The results of previous researches showed that patients with taste disturbance, dry mouth, anorexia, experienced greater weight loss, reduction of energy and protein intake than those who didn't have eating problem (Bolze *et al*., 1982; Rue Redda and Allis, 2006) which was in agreement with our results.

In our study, we observed incidence of the most symptoms increased significantly during the first three weeks of therapy, also in these weeks, the most weight loss, reduction of dietary intake experienced by the patients. Overall, symptoms significantly affected weight loss and reduction of dietary intake. It is possible that reliance on soup and drinks that is, food of minimal nutritional value contributed to the significant weight loss and reduction of energy and protein intake reported while a balanced diet rich in essential nutrients is necessary to provide an ideal environment for optimal tissue repair (Porock, 2002).

CONCLUSION

Improved the understanding about the time course and dose of radiation-induced toxicity will permit more accurate presentation of side effect risk at the time patient consent is obtained. Therefore, daily assessment of side-effects, symptom support and nutritional advice adjusted to the individual patient are parts of adequate nutritional care.

Further studies are needed to elucidate the situation experience by patients with cancer during radiotherapy, as well as to explore the period after completion of treatment. In addition, intervention studies are needed to provide optimal clinical guidelines for nutritional intervention of patients treated with radiotherapy.

ACKNOWLEDGEMENT

Financial support of Tabriz University of Medical Sciences is gratefully acknowledged. Also, we are grateful to the patients who took part in the study.

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