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A Prospective Longitudinal Clinical Trial Evaluating Quality of Life After Breast Conserving Surgery and High-Dose-Rate Interstitial Brachytherapy for Early-Stage Breast Cancer

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Abstract

Purpose—To prospectively examine quality of life (QOL) of patients with early-stage breast cancer treated with accelerated partial breast irradiation (APBI) using high-dose-rate (HDR) interstitial brachytherapy.

Methods And Materials—Between March 2004 and December 2008, 151 patients with early-stage breast cancer were enrolled in a phase II prospective clinical trial. Eligible patients included those with Tis-T2 tumors measuring ≤ 3 cm excised with negative surgical margins, with no nodal involvement. Patients received 3.4 Gy bid to a total dose of 34 Gy. QOL was measured using the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 version 3.0 and QLQ-BR23 questionnaires. The QLQ-C30 and QLQ-BR23 were evaluated pretreatment, 6-8 weeks, 3-4 months, 6-8 months, 1 year and 2 years after treatment.

RESULTS—The median follow-up was 55 months. Breast symptom scores remained stable in the months after treatment, and they significantly improved 6-8 months after treatment. Scores for emotional functioning, social functioning, and future perspective showed significant improvement 2 years after treatment. Symptomatic fat necrosis was associated with several changes in QOL, including increased pain, breast symptoms, systemic treatment side effects, dyspnea, and fatigue, as well as decreased role functioning, emotional functioning, and social functioning.

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Conclusions—HDR multicatheter interstitial brachytherapy was well tolerated with no significant detrimental effect on measured QOL scales/items through 2 years of follow-up. Compared to pretreatment scores, there was improvement in breast symptoms, emotional functioning, social functioning and future perspective 2 years after treatment.

Keywords

Breast cancer; brachytherapy; quality of life; partial breast

Introduction

Breast-conserving surgery followed by whole-breast irradiation (WBI) is a standard treatment for early-stage breast cancer. The majority of local recurrences after breast-conserving surgery are at or near the lumpectomy site (1). This observation has led to increasing interest in accelerated partial breast irradiation (APBI) as an alternative to WBI. APBI can be completed within several days as compared to several weeks for conventional WBI. Early prospective evidence suggests that ipsilateral breast tumor recurrence rates are low after APBI (2).

The excellent local control and overall survival rates for women with early-stage breast cancer make it important to minimize the toxicity of treatment and its effect on quality of life (QOL). To date, published reports of QOL after APBI have been limited (3, 4). We report the results of a single institution, prospective, clinical trial evaluating longitudinal QOL in a large cohort of patients treated with APBI using high-dose-rate (HDR) multicatheter interstitial brachytherapy. We examined clinical and treatment-related factors that could impact QOL.

Methods and Materials

Between March 2004 and December 2008, 151 patients with early-stage breast cancer were enrolled in a prospective phase II clinical trial evaluating APBI using HDR multicatheter interstitial brachytherapy at XXXX. Selection criteria included patients with unifocal American Joint Committee on Cancer (AJCC, 6th edition) Tis-T2N0M0 breast cancers 3 cm treated with breast-conserving surgery. All but one of the 123 patients with invasive disease had a sentinel lymph node biopsy. Patients were ineligible if they had: 1) lobular carcinoma *in-situ* (LCIS), 2) multicentric carcinoma, 3) diffuse suspicious microcalcifications, 4) suspicious microcalcifications remaining on the post-lumpectomy mammogram, or 5) systemic lupus erythematosus, scleroderma, or dermatomyositis with a CPK level above normal or with an active skin rash. The XXXX Human Research Protection Office approved this study, and all patients provided written informed consent.

All patients were treated with HDR multicatheter interstitial brachytherapy using a high activity Iridium-192 source. The interstitial implants were placed using a free hand technique with the goal of encompassing the surgical cavity with a 2 cm margin of breast tissue in all directions. In general, an intraplane catheter spacing of 1.2 cm and an interplane spacing of 1.5 to 2.0 cm were used. All implants were multiplanar, and the use of more than two planes was common. Interstitial implants were placed intraoperatively with a reopened surgical cavity in thirteen patients, including the first eight patients in the trial. This was done as a separate operative procedure from the breast conserving surgery, after the final pathology was known. Real-time ultrasound guidance with an unopened surgical cavity was predominantly used after the first eight cases. Real-time ultrasound guided implantation was performed using a strict sterile technique and under a combination of narcotic and anxiolytic sedation with local anesthesia.

All patients underwent computed tomography (CT) simulation and three-dimensional treatment planning. The Plato Brachytherapy planning system (Nucletron BV, Veenendaal, The Netherlands) was used through November 2006, after which treatment planning was done using the BrachyVision treatment planning system (Varian Medical Systems Inc., Palo Alto, CA). The planning target volume (PTV) was created by adding a uniform 2 cm margin to the surgical cavity contour and subsequently limited to 5 mm away from the skin surface. The pectoral muscles, chest wall, and axilla were excluded from the PTV.

Patients received 3400 cGy delivered in 10 twice-daily fractions. Treatment was given over 5-7 days, with a minimum of 6 hours separation between fractions. Dosimetric goals were:

95% of the PTV receiving the prescribed dose, $V_{150} \geq 50 \text{ cm}^3$, $V_{200} \geq 20 \text{ cm}^3$, and dose homogeneity index, defined as $1 - (V_{150}/V_{100}) \leq 0.7$, where V_x is the volume receiving $x\%$ of the prescription dose (5). If all dosimetric goals could not be achieved in a particular case, then coverage was optimized at the expense of exposure.

Chemotherapy and hormonal therapy were administered at the discretion of the consulting medical oncologist. Chemotherapy was started at least 4 weeks after completion of APBI. Hormonal therapy was allowed during brachytherapy, but in practice was rarely started prior to APBI.

QOL assessment and follow-up

QOL was assessed using the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30, version 3.0 (6) and the EORTC breast cancer module QLQ-BR23 (7) questionnaires. Permission to use both questionnaires was provided by the EORTC. These questionnaires have been validated in international studies (6-8). QLQ-C30 is composed of 30 questions organized into a global health status/QOL scale, five functional scales (physical, role, emotional, cognitive, and social), three symptom scales (fatigue, nausea and vomiting, and pain), and a number of single items assessing additional symptoms (dyspnea, insomnia, appetite loss, constipation, diarrhea, and financial difficulties). QLQ-BR23 consists of 23 questions organized into four functional scales (body image, sexual functioning, sexual enjoyment, and future perspective) and four symptom scales/items (systemic side effects, breast symptoms, arm symptoms, and upset by hair loss). Scoring of the QLQ-C30 and QLQ-BR23 was performed according to the EORTC scoring manual (9). Missing QOL data were handled as described in the EORTC scoring manual: if half the items (or more) from the scale were answered, then the scale value was calculated from those given values. All scores were linearly converted to a 0–100-point scale. For the functional and global health status/QOL scales, higher scores represent a better level of functioning. For the symptom scales, higher scores represent a greater degree of symptoms. Patients completed the QLQ-C30 and QLQ-BR23 questionnaires pretreatment, during brachytherapy, 6-8 weeks post-treatment, 3-4 months post-treatment, 6-8 months post-treatment, then every 6 months for the next 4.5 years. QOL questionnaire administration was stopped if a patient developed a locoregional recurrence or distant metastasis. The quality of life questionnaires were presented to the patient by a trained radiation oncology nurse.

Fat necrosis was diagnosed by mammogram or clinical findings such as pain, redness, or a palpable mass. Biopsy was done in uncertain cases for histologic confirmation. Because of a lack of a standard toxicity scoring system for fat necrosis, an institutional scoring system was developed and used to grade fat necrosis (10). Symptomatic fat necrosis (defined as grade 2) required analgesic medication or surgical intervention for management. In general, symptomatic fat necrosis was initially treated with ketorolac 10 mg po tid for 5 days, followed by a course of naproxen sodium 220 mg po bid. Narcotic analgesics were often prescribed initially, for the first 1-2 weeks. Narcotic analgesics were subsequently prescribed if pain was not adequately controlled with naproxen sodium. Surgery was ideally

reserved for severe symptomatic fat necrosis that was not adequately controlled with analgesics.

Demographic Information

Patient reported demographic data including race and marital status were obtained from a patient questionnaire completed prior to brachytherapy. Patients were categorized as living in urbanized areas (50,000 or more people), urban clusters (2,500-49,999 people), or rural (population not within an urbanized area or urban cluster) based on the 2010 U.S. Census Bureau classification (11).

Statistical Analysis

The pretreatment assessment was made after surgery and prior to brachytherapy. All time intervals were calculated from the date of completion of HDR interstitial brachytherapy. The Kaplan-Meier method was used to estimate ipsilateral breast tumor recurrence (IBTR) and disease-free survival (DFS). QOL was analyzed through 2 years of follow-up in order to maximize the number of patient responses available for analysis. 112 patients (74%) had QOL data through two years of follow-up. QOL data were analyzed at pretreatment and at 6-8 weeks, 3-4 months, 6 months, 12 months, and 2 years after treatment. The effect of time on QOL was assessed with a mixed repeated measures model using a heterogeneous autoregressive covariance structure. A p value of < 0.05 was considered statistically significant. Statistical analyses were performed using StatView (version 5.0.1; SAS Institute Inc., Cary, NC) and SAS (version 9.2; SAS Institute Inc., Cary, NC).

Results

Patient, cancer, and treatment-related factors are summarized in Table 1. 85% of the patients were Caucasian, and the remainder were African-American. 73% lived in an urban area, 17% lived in an urban cluster, and 10% lived in a rural area. Dosimetric goals for V150, V200 and dose homogeneity index were met for 72% of patients. The median follow-up was 55 months (range, 1-81 months). The estimated 2 and 5-year IBTR rates were 0.07% and 3.4%, respectively. Estimated 2 and 5-year DFS were 99.3% and 94.4%, respectively. The percentage of patients completing QOL questionnaires at each time point was 99% at 6-8 weeks, 95% at 3-4 months, 91% at 6-8 months, 88% at 1 year, and 74% at 2 years. Compliance rates for completion of the QLQ-C30 and QLQ-BR23 scales and items were generally high (89-100%) with the exception of sexual function, sexual enjoyment and upset by hair loss, which had a wide range of completion rates at different time points (47-97%).

QLQ-C30 scale and item scores are presented in Figure 1(a). Emotional functioning and social functioning scores showed significant improvement 2 years after treatment, compared to pretreatment. Financial difficulties scores were significantly lower 2 years after treatment. The remainder of the scores, including global health status/QOL, physical functioning, role functioning, and pain showed no significant change up to 2 years after treatment. QLQ-BR23 scale and item scores are presented in Figure 1(b). Future perspective showed significant improvement beginning 6-8 months after treatment. Breast symptoms were not significantly different 6-8 weeks after treatment, and were significantly improved beginning 6-8 months after treatment. Systemic therapy side effects were significantly higher at 6-8 weeks and 3-4 months after treatment. The remainder of scale/item scores showed no significant difference from pretreatment values through 2 years of follow-up.

To analyze the effect of patient and treatment-related characteristics on QOL, a mixed repeated measures model was utilized. Analyzed variables included chemotherapy, hormonal therapy, marital status (married vs. not married), race, community (urbanized area,

urbanized cluster, or rural), V100, V150, breast infection, and symptomatic fat necrosis. Significant results are presented in Table 2; nonsignificant results are not presented. Hormone therapy was the only variable associated with a significant decrease in global health status/QOL. Hormone therapy was also associated with detrimental effects on a number of other QOL scales and items detailed in Table 2. African American patients had significantly worse physical functioning, sexual functioning, systemic treatment side effects, arm symptoms, appetite loss and constipation than Caucasian patients. Married patients had higher physical and sexual functioning scores than non-married patients. Symptomatic fat necrosis developed in 19 patients (12.6 %). Only one patient had surgery for symptomatic fat necrosis inadequately controlled with analgesics. Symptomatic fat necrosis was associated with worse breast symptoms, systemic treatment side effects, pain, dyspnea, body image, role functioning, emotional functioning, social functioning, and fatigue.

Discussion

We report the results of a prospective, longitudinal study of QOL outcomes after APBI using HDR multicatheter interstitial brachytherapy for early-stage breast cancer. Minimizing effects on QOL is an important goal of breast conserving therapy. This study used the validated EORTC QLQ-C30 version 3.0 and QLQ-BR23 questionnaires to assess QOL both before and after APBI. To our knowledge, this is the largest series to date evaluating QOL after APBI.

In the first 3-4 months after treatment, the only significant change in the measured QOL scales/items was an increase in systemic therapy side effects. Breast symptom scores remained stable in the months after treatment, and they significantly improved beginning 6-8 months after treatment. Future perspective showed significant improvement beginning 6-8 months after treatment. Emotional functioning and social functioning scores improved over time and were significantly improved 2 years after treatment. Financial difficulty scores showed significant improvement 2 years after treatment, indicating that patients had less financial difficulty due to their medical treatment. There was no significant change in the remainder of the scales/scores including global health status/QOL, physical functioning, role functioning, pain, body image, arm symptoms, sexual functioning and sexual enjoyment. These results indicate that HDR multicatheter interstitial brachytherapy has no significant detrimental effect on the measured QOL scales/items through 2 years of follow-up, and that improvement in breast symptoms, emotional functioning, social functioning and future perspective is seen at 2 years.

Other series examining QOL have also shown APBI using brachytherapy to be a well tolerated treatment. In an abstract, Flynn *et al.* (12) reported QOL measured by the QLQ-C30 for 60 patients treated with either WBI or APBI using interstitial brachytherapy. For the patients who received brachytherapy, all functional and symptom scores surpassed baseline scores three months after treatment. Four years after treatment, there was significant improvement in role, cognitive, social and emotional mean scores compared to baseline. When compared to the group who received WBI, the brachytherapy patients had lower functional and higher symptomatology scores initially, however by seven weeks post-treatment, the mean scores in both groups surpassed their baseline scores. In another abstract by Flynn *et al.* (13), QOL was reported for patients treated with WBI or APBI using either 3D conformal radiation therapy, MammoSite, or Contura multilumen balloon brachytherapy. For both the APBI and WBI groups, QOL values returned to baseline for 14 of 18 scales/scores within three months. It is important to note that both of the aforementioned studies were nonrandomized.

The results of our study compare favorably to studies evaluating QOL after WBI. Rayan *et al.* (14) evaluated QOL of patients in a randomized trial of breast-conserving surgery and tamoxifen with or without adjuvant WBI. Using the QLQ-C30 and QLQ-BR23, there was no significant difference in QOL between the two groups up to 12 months after treatment.

A matched pair analysis of 48 women treated with either WBI or APBI using HDR interstitial brachytherapy was reported by Wadasadawala *et al.* (4). At a median follow-up of 3 years, patients who received APBI had improved body image and less financial difficulties compared to the group that received WBI. QOL data were not available for different time points, precluding an analysis of changes in QOL over time. To our knowledge, there has been no randomized study comparing QOL after WBI and APBI. The available nonrandomized data suggest that APBI is well tolerated, and is generally comparable to WBI with respect to effects on QOL.

In the present study, an examination of brachytherapy treatment-related variables indicates that symptomatic fat necrosis was associated with changes in several QOL domains, including increased pain, breast symptoms, systemic treatment side effects, dyspnea, and fatigue, as well as decreased role functioning, emotional functioning, and social functioning. Symptomatic fat necrosis may present as some combination of a palpable mass, mastalgia, or overlying skin erythema, requiring analgesic medication or surgical intervention for pain control. The incidence of symptomatic fat necrosis was 12.6%, consistent with the rate reported in other series of patients treated with interstitial APBI (15, 16). Symptomatic fat necrosis was associated with detrimental changes in a broad range of QOL measures, not just pain and breast symptoms. In a prior analysis that included the patients in the present study, $V150 > 65 \text{ cm}^3$ was associated with a significantly higher rate of fat necrosis (10). Limiting high dose volumes, particularly V150, may reduce the risk of fat necrosis which may, in turn, improve QOL.

Systemic therapy was associated with detrimental changes in a number of QOL scales/items. Chemotherapy was associated with significantly increased diarrhea and upset by hair loss scores, and a decreased body image score. Hormone therapy was associated with decreased global health status/QOL, physical functioning, role functioning, emotional functioning, cognitive functioning and future perspective scores. Hormone therapy was also associated with increased nausea and vomiting, dyspnea, insomnia, appetite loss, constipation, financial difficulties, breast symptoms and arm symptom scores. Other studies evaluating QOL after chemotherapy or hormone therapy have also shown similar changes in a number of QOL domains (17-20).

African American race was associated with worse appetite loss, constipation, systemic treatment side effects and arm symptoms, and lower physical functioning and sexual functioning. Lower QOL in African American women with breast cancer has been reported in other studies (21, 22). In the present study, we did not collect data on other socioeconomic factors such as income, employment status, education, and support structure, which may contribute to the observed findings. The disparity in QOL outcomes based on race is an important finding that warrants additional investigation. Married patients had higher physical functioning and sexual functioning scores than unmarried patients. While the unmarried group of patients includes a heterogeneous group of patients who may or may not be in a relationship, these results indicate an overall improvement in these QOL domains for married patients.

The patient population in this study was predominantly Caucasian and the majority of patients lived in an urban area. It is possible that the results of this study are not generalizable to patients of other racial/ethnic backgrounds or predominantly rural

populations. Another potential limitation is that only 74% of patients had QOL data through 2 years of follow-up. Lastly, socioeconomic data was not collected in this study. A number of socioeconomic factors may contribute to QOL, including employment status, income, and education.

Conclusions

HDR multicatheter interstitial brachytherapy is well tolerated with no significant detrimental effect on measured QOL scales/items through 2 years of follow-up. Compared to pretreatment scores, there is improvement in breast symptoms, emotional functioning, social functioning and future perspective 2 years after treatment. With respect to brachytherapy treatment-related factors, symptomatic fat necrosis was associated with detrimental changes in several QOL domains.

References

1. Fisher ER, Sass R, Fisher B, et al. Pathologic findings from the National Surgical Adjuvant Breast Project (protocol 6). II. Relation of local breast recurrence to multicentricity. *Cancer*. 1986; 57:1717–1724. [PubMed: 2856856]
2. Smith BD, Arthur DW, Buchholz TA, et al. Accelerated partial breast irradiation consensus statement from the American Society for Radiation Oncology (ASTRO). *J Am Coll Surg*. 2009; 209:269–277. [PubMed: 19632605]
3. Belkacemi Y, Chauvet MP, Giard S, et al. Partial breast irradiation as sole therapy for low risk breast carcinoma: early toxicity, cosmesis and quality of life results of a MammoSite brachytherapy phase II study. *Radiother Oncol*. 2009; 90:23–29. [PubMed: 18692927]
4. Wadasadawala T, Budrukkar A, Chopra S, et al. Quality of life after accelerated partial breast irradiation in early breast cancer: matched pair analysis with protracted whole breast radiotherapy. *Clin Oncol (R Coll Radiol)*. 2009; 21:668–675. [PubMed: 19734028]
5. Arthur DW, Koo D, et al. The Importance of Dose Volume Histogram Evaluation in Partial Breast Brachytherapy: A Study of Dosimetric Parameters [abstract]. *Int J Radiat Oncol Biol Phys*. 2003; 52:S361–362.
6. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst*. 1993; 85:365–376. [PubMed: 8433390]
7. Sprangers MA, Groenvold M, Arraras JI, et al. The European Organization for Research and Treatment of Cancer breast cancer-specific quality-of-life questionnaire module: first results from a three-country field study. *J Clin Oncol*. 1996; 14:2756–2768. [PubMed: 8874337]
8. Osoba D, Aaronson N, Zee B, et al. Modification of the EORTC QLQ-C30 (version 2.0) based on content validity and reliability testing in large samples of patients with cancer. The Study Group on Quality of Life of the EORTC and the Symptom Control and Quality of Life Committees of the NCI of Canada Clinical Trials Group. *Qual Life Res*. 1997; 6:103–108. [PubMed: 9161109]
9. Fayers PM, Bjordal K, Groenvold M, Curran D, Bottomley A, on behalf of the EORTC Quality of Life Group. The EORTC QLQ-C30 Scoring Manual. 3. Published by: European Organisation for Research and Treatment of Cancer; Brussels: 2001.
10. XXXX
11. [Accessed January 31, 2013.] 2010 Census Urban and Rural Classification and Urban Area Criteria. Available at: <http://www.census.gov/geo/reference/urban-rural-2010.html>
12. Flynn C, Hardy M, Mitchell C, Wallace M, Vicini F, Martinez A. A comparison of quality of life (QOL) for patients with early stage breast cancer treated with whole breast irradiation versus targeted partial breast brachytherapy [abstract]. *Int J Radiat Oncol Biol Phys*. 2003; 57:S310.
13. Flynn CJ, Mitchell C, Limbacher A, Vicini F, Martinez A. A Comparison of Quality of Life for Early Stage Breast Cancer Examining Whole Breast IMRT versus Accelerated Partial Breast Irradiation [abstract]. *Int J Radiat Oncol Biol Phys*. 2010; 78:S609–610.

14. Rayan G, Dawson LA, Bezjak A, et al. Prospective comparison of breast pain in patients participating in a randomized trial of breast-conserving surgery and tamoxifen with or without radiotherapy. *Int J Radiat Oncol Biol Phys.* 2003; 55:154–161. [PubMed: 12504048]
15. Lovey K, Fodor J, Major T, et al. Fat necrosis after partial-breast irradiation with brachytherapy or electron irradiation versus standard whole-breast radiotherapy--4-year results of a randomized trial. *Int J Radiat Oncol Biol Phys.* 2007; 69:724–731. [PubMed: 17524571]
16. Wazer DE, Kaufman S, Cuttino L, et al. Accelerated partial breast irradiation: an analysis of variables associated with late toxicity and long-term cosmetic outcome after high-dose-rate interstitial brachytherapy. *Int J Radiat Oncol Biol Phys.* 2006; 64:489–495. [PubMed: 16246495]
17. Boyea GFC, Balasubramaniam M, Wallace M, Vicini F, Martinez A. A Two Year Comparison of Quality of Life for Early Stage Breast Cancer Patients Treated with Whole Breast IMRT with and without Chemotherapy [abstract]. *Int J Radiat Oncol Biol Phys.* 2008; 72:S196.
18. Hopwood P, Haviland J, Mills J, et al. The impact of age and clinical factors on quality of life in early breast cancer: an analysis of 2208 women recruited to the UK START Trial (Standardisation of Breast Radiotherapy Trial). *Breast.* 2007; 16:241–251. [PubMed: 17236771]
19. Land SR, Wickerham DL, Costantino JP, et al. Patient-reported symptoms and quality of life during treatment with tamoxifen or raloxifene for breast cancer prevention: the NSABP Study of Tamoxifen and Raloxifene (STAR) P-2 trial. *JAMA.* 2006; 295:2742–2751. [PubMed: 16754728]
20. Cella D, Fallowfield L, Barker P, et al. Quality of life of postmenopausal women in the ATAC ("Arimidex", tamoxifen, alone or in combination) trial after completion of 5 years' adjuvant treatment for early breast cancer. *Breast Cancer Res Treat.* 2006; 100:273–284. [PubMed: 16944295]
21. Paskett ED, Alfano CM, Davidson MA, et al. Breast cancer survivors' health-related quality of life : racial differences and comparisons with noncancer controls. *Cancer.* 2008; 113:3222–3230. [PubMed: 18973178]
22. Matthews AK, Tejeda S, Johnson TP, et al. Correlates of quality of life among African American and white cancer survivors. *Cancer Nurs.* 2012; 35:355–364. [PubMed: 22495496]
23. Flynn CJ, Mitchell C, Boyea G, Vicini G, Martinez A. A Comparison of Quality of Life for Early Stage Breast Cancer Examining Various Treatment Modalities and NO Chemotherapy [abstract]. *Int J Radiat Oncol Biol Phys.* 2007; 69:S583–584.

Summary

Quality of life was analyzed for 151 patients with early-stage breast cancer treated with accelerated partial breast irradiation using high-dose-rate (HDR) interstitial brachytherapy. Interstitial brachytherapy was well tolerated, with no significant detrimental effect on measured QOL scales/items through 2 years of follow-up. Compared to pretreatment scores, there was improvement in breast symptoms, emotional functioning, social functioning and future perspective 2 years after treatment.

Figure 1.

Changes in quality of life over time for the (a) QLQ-C30 and (b) QLQ-BR23 questionnaires. These graphs show changes in mean quality-of-life scores over time for each domain. All scores were linearly converted to a 0–100-point scale. For the functional and global health status/QOL scales, higher scores represent a better level of functioning. For the symptom scales, higher scores represent a greater degree of symptoms. Error bars represent 95% confidence intervals. Asterisks (*) designate time points at which differences from baseline were significant. *Abbreviations:* pretx = pretreatment; wks = weeks

Table 1
Patient, tumor and treatment-related characteristics

Characteristic	Findings
Age (y)	
Mean (range)	60 (40-85)
40-50	29 (19%)
50-60	50 (33%)
>60	72 (48%)
Race	
Caucasian	128 (85%)
African-American	23 (15%)
Marital Status (at diagnosis)	
Married	82 (54%)
Divorced	20 (13%)
Widowed	29 (19%)
Single	19 (13%)
Residence (at diagnosis)	
Urban area	111 (73%)
Urban cluster	25 (17%)
Rural	15 (10%)
Tumor Location	
UOQ	54 (36%)
UIQ	46 (30%)
LOQ	30 (20%)
LIQ	21 (14%)
Pathologic tumor stage	
Tis	28 (19%)
T1mic	1 (1%)
T1a	19 (13%)
T1b	52 (34%)
T1c	38 (25%)
T2	13 (9%)
Sentinel lymph node biopsy (for patients with invasive cancer)	
Yes	122 (99%)
No	1 (1%)
Chemotherapy	
Yes	30 (20%)
No	121 (80%)
Hormonal therapy	
Yes	116 (77%)
No	35 (23%)
Mean V100 (range)	246 (99.6-690) cm ³

Characteristic	Findings
Mean V150 (range)	45.2 (19.1-129) cm ³
Mean V200 (range)	16.1 (7-39.8) cm ³
Mean DHI (range)	0.808 (0.680-0.880)
Toxicity	
Breast infection	6 (4%)
Symptomatic fat necrosis 19	(12.6%)

Abbreviations: UOQ = upper outer quadrant; UIQ = upper inner quadrant; LOQ = lower outer quadrant; LIQ = lower inner quadrant; DHI = dose homogeneity index.

Table 2

Effect of patient and treatment-related characteristics on quality-of-life.

Variable	QOL scale or item	Estimate (Standard Error)	<i>p</i>
Chemotherapy			
	Diarrhea	5.34 (1.39)	0.0002
	Body image	-7.08 (2.01)	0.0006
	Upset by hair loss	28.0 (5.50)	<0.0001
Hormone therapy			
	Global health status/QOL	-7.26 (2.58)	0.006
	Physical functioning	-5.07 (2.36)	0.003
	Role functioning	-5.53 (2.56)	0.003
	Emotional functioning	-8.39 (2.67)	0.002
	Cognitive functioning	-5.63 (2.72)	0.04
	Nausea and vomiting	3.62 (0.90)	<0.0001
	Dyspnea	7.32 (2.89)	0.013
	Insomnia	10.6 (3.34)	0.002
	Appetite loss	5.65 (2.08)	0.008
	Constipation	9.48 (2.63)	0.0004
	Financial difficulties	5.25 (2.93)	0.075
	Future perspective	-11.32 (3.83)	0.004
	Breast symptoms	3.52 (1.55)	0.002
	Arm symptoms	4.86 (1.82)	0.008
Marital status (married)			
	Physical functioning	6.54 (0.86)	0.0006
	Sexual functioning	12.8 (2.86)	<0.0001
Race (African American)			
	Physical functioning	-7.79 (2.53)	0.003
	Appetite loss	7.45 (2.27)	0.001
	Constipation	7.95 (3.09)	0.001
	Sexual functioning	-11.1 (3.99)	0.006
	Systemic treatment side effects	3.97 (1.99)	0.049
	Arm symptoms	4.63 (2.02)	0.023
V150			
	Sexual functioning	-0.22 (0.10)	0.025
Infection			
	Social functioning	9.75 (4.10)	0.018
Symptomatic fat necrosis			
	Role functioning	-6.07 (3.03)	0.047
	Emotional functioning	-6.92 (3.16)	0.03
	Social functioning	-7.17 (2.59)	0.006
	Fatigue	10.4 (3.08)	0.0009
	Pain	8.13 (2.27)	0.0005

Variable	QOL scale or item	Estimate (Standard Error)	<i>p</i>
	Dyspnea	8.75 (3.43)	0.017
	Body image	5.8 (2.44)	0.019
	Systemic treatment side effects	4.98 (2.16)	0.022
	Breast symptoms	7.66 (1.82)	<0.0001

Abbreviations: QOL = quality of life