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Quality of Life After Breast Cancer Surgery in Patients Receiving Adjuvant Radiotherapy: A Cross-Sectional Analysis

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ABSTRACT

Objective: As breast cancer survivorship improves, quality of life (QoL) has become a key determinant in treatment decision-making. While breast-conserving approaches are widely adopted, variations in surgical extent persist across clinical settings. This study aimed to compare patient-reported QoL scores between women undergoing breast-conserving surgery and those undergoing modified radical mastectomy in the context of adjuvant radiotherapy.

Materials and Methods: This single-center, cross-sectional, observational study included 98 women who were treated at a tertiary hospital between January 2021 and January 2024. Of 200 potentially eligible patients contacted, 98 consented and completed the European Organisation for Research and Treatment of Cancer core quality of life questionnaire (QLQ-C30) and the breast cancer-specific module (QLQ-BR23) after radiotherapy. Fifty-eight patients underwent breast-conserving surgery, and 40 underwent modified radical mastectomy. Scores were transformed to a 0-100 scale; functional and global health scales were interpreted conventionally, and symptom summaries were oriented so that higher scores reflected lower symptom burden. Unadjusted group comparisons were performed using the Mann-Whitney U test, and exploratory correlations were assessed using Spearman correlation coefficients.

Results: Patients treated with breast-conserving surgery reported higher QLQ-C30 functional scores than those treated with modified radical mastectomy (median 60.00 *vs.* 46.66; $p = 0.005$) and higher global health status scores (66.66 *vs.* 37.50; $p<0.001$). Symptom summary scores also favored breast conservation (67.94 *vs.* 58.97; $p = 0.001$). On the QLQ-BR23, the breast-conserving group reported higher functional scores (57.77 *vs.* 44.44; $p = 0.008$) and higher symptom summary scores (87.50 *vs.* 84.38; $p = 0.045$). These values represent unadjusted between-group differences and should be interpreted in light of the observational design and the unavailability of clinical covariates.

Conclusion: In patients receiving adjuvant radiotherapy, less extensive breast surgery was associated with more favorable patient-reported quality of life outcomes. These findings highlight the importance of incorporating survivorship outcomes into shared decision-making in breast cancer care.

Keywords: Breast cancer; breast surgery; breast conserving surgery; modified radical mastectomy; radiotherapy; patient reported outcomes; quality of life; EORTC QLQ-C30; EORTC QLQ-BR23; STROBE

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KEY POINTS

- Breast-conserving surgery was associated with better patient-reported quality of life than modified radical mastectomy in patients receiving adjuvant radiotherapy.
- Patients treated with breast-conserving surgery reported higher European Organisation for Research and Treatment of Cancer (EORTC) QLQ-C30 functional scores and global health status scores.
- Breast cancer-specific EORTC QLQ-BR23 functional outcomes also favored breast-conserving surgery.
- Less extensive breast surgery may contribute to lower symptom burden and better survivorship experience after radiotherapy.
- Quality of life outcomes should be incorporated into shared decision-making when breast-conserving surgery is oncologically feasible.

Introduction

Breast cancer remains the most commonly diagnosed malignancy in women worldwide, and growing survivorship has shifted attention from oncologic control alone to long-term functional and psychosocial outcomes (1). For women with operable disease, the choice between breast conserving surgery (BCS) and mastectomy is therefore not purely technical. It is also a quality of life decision that can shape body image, daily activities, symptom burden, treatment satisfaction, and social recovery after therapy.

Long-term randomized trials established that, in appropriately selected patients, BCS followed by radiotherapy (RT) provides survival outcomes comparable to mastectomy (2, 3). Once this oncologic equivalence is accepted, patient-reported outcomes become highly relevant. The extent of breast removal may influence how patients perceive physical recovery, femininity, intimacy, and overall health after treatment. These dimensions are important in contemporary shared decision-making, particularly when more than one local treatment strategy is feasible.

Health-related quality of life after breast cancer surgery is multidimensional and may be affected by age, tumor burden, adjuvant systemic therapy, RT-related effects, complications, and psychosocial context. The European Organisation for Research and Treatment of Cancer (EORTC) core questionnaire (QLQ-C30) and breast-specific module (QLQ-BR23) are among the best validated instruments for capturing these outcomes in a standardized way (4, 5). Their combined use allows assessment of both global cancer-related functioning and breast-cancer-specific concerns, such as body image and treatment-related symptoms.

Existing observational literature generally suggests that breast conservation is associated with better body image and more favorable psychosocial outcomes than mastectomy, although the magnitude of this advantage varies across populations and treatment pathways (6-8). Engel et al. (6), Arndt et al. (7), and later comparative studies and meta-analyses showed that quality of life differences may persist beyond the acute postoperative phase. However, many cohorts mix patients with and without RT, include heterogeneous reconstructive pathways, or reflect healthcare environments that differ from routine tertiary practice in our region.

Because reporting of observational data should be methodologically transparent, the present study was structured in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies (9). We compared patient-reported quality of life in women who underwent BCS or modified radical mastectomy (MRM), all of whom completed postoperative RT at a tertiary referral center. We hypothesized that less extensive surgical approaches would be associated with more favorable patient-reported outcomes in this post-RT cohort.

While surgical practice has evolved toward breast conservation in many high-income settings, substantial variation persists globally, particularly in heterogeneous and resource-variable healthcare environments. Therefore, comparing patient-reported outcomes across surgical approaches remains clinically relevant, especially in the context of adjuvant RT, which may influence long-term survivorship experiences.

Materials and Methods

Study Design and Setting

This single-center, cross-sectional, observational study was conducted at the general surgery clinic of a tertiary training and research hospital. The study period extended from January 2021 through January 2024. Reporting was aligned with the STROBE statement for cross-sectional studies. The primary objective was to compare quality of life outcomes between women treated with BCS and those treated with MRM after completion of postoperative RT. Secondary exploratory objectives were to examine correlations between selected treatment intensity variables and quality of life summary scores.

Participants

Women aged 18 years or older with histologically confirmed breast cancer who had undergone definitive breast surgery and completed postoperative RT were eligible. Potentially eligible patients were identified from institutional follow-up records

and contacted to participate. Of 200 women approached, 98 consented to and completed the study procedures: 58 in the BCS group and 40 in the MRM group. Patients were excluded if they had not completed RT, had active recurrent disease at the time of survey administration, or had been unable to complete the questionnaires reliably. Because chemotherapy-related variables were included in exploratory analyses, prior systemic therapy was not considered an exclusion criterion.

Data Collection and Variables

Quality of life was assessed after completion of RT in the outpatient oncology setting using the EORTC QLQ-C30 and QLQ-BR23. Questionnaires were administered either as supervised self-report or through direct interview. The QLQ-C30 evaluates physical, role, emotional, cognitive, and social functioning, global health status, and symptom burden. The QLQ-BR23 complements this with breast-cancer-specific domains including body image, sexual functioning, future perspective, and treatment-related symptoms. Scores were transformed to a 0–100 scale. Functional domains and global health status were interpreted conventionally, with higher scores indicating better status. To maintain intuitive consistency across summary analyses, symptom summary scores were oriented so that higher values reflected a lower symptom burden, which differs from the conventional presentation of raw EORTC symptom scales and was stated explicitly to avoid misinterpretation.

Additional variables abstracted from clinical records included age, chemotherapy cycles, RT cycles, chemotherapy duration, and RT duration. These variables were used only for exploratory association analyses. The source dataset did not contain sufficiently complete and standardized patient-level data on tumor and nodal stage, pathological characteristics, receptor or molecular subtype, systemic treatment categories, axillary surgery, reconstruction, menopausal status, body mass index, RT technique and target volumes, or intervals from surgery and RT completion to questionnaire administration. These variables, therefore, could not be reported by treatment group or included in adjusted analyses.

Bias and Study Size

Several sources of bias were considered. First, treatment allocation was non-random and determined by clinical indications and patient-physician decision-making, introducing confounding by indication and potential selection bias. Second, 98 of the 200 women contacted participated (49.0%); characteristics of non-participants were unavailable for comparison, and, therefore, non-response bias cannot be excluded. Third, quality of life was measured at a single post-RT time point, and the interval between treatment completion and questionnaire administration was not available. These issues were addressed by presenting participant flow transparently, avoiding causal language, and interpreting the findings as unadjusted associations. The sample size was pragmatic and reflected the number of eligible and consenting patients during the study period; no formal a priori sample size calculation was performed.

Ethics

The study protocol was approved by the University of Health Sciences Türkiye, Ümraniye Training and Research Hospital Scientific Research Ethics Committee (approval no: 83, date: March 28, 2024). All participants provided informed consent before questionnaire administration. Data were analyzed anonymously, and the study was conducted in accordance with the Declaration of Helsinki and institutional requirements for observational human research.

Statistical Analysis

Continuous data were summarized using medians and ranges. Between-group comparisons of QLQ-C30 and QLQ-BR23 summary scores were performed using the Mann-Whitney U test. All tests were two-sided, and $p<0.05$ was considered statistically significant. Exploratory correlations among age, treatment intensity measures, and quality of life summaries were examined using Spearman coefficients. No adjustment for multiple comparisons was applied because these analyses were exploratory; the reported p-values are therefore unadjusted. Multivariable regression and propensity-based adjustment were not performed because the principal clinical covariates required to address confounding by indication were unavailable. A model restricted to the few recorded variables would not have adequately controlled for the major expected differences between the surgical groups. Effect sizes and 95% confidence intervals could not be calculated reliably because patient-level data and complete Mann-Whitney U test outputs were unavailable in the archived analytic dataset. Statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Participant selection is summarized in Figure 1.

Results

A total of 98 women were included in the final analysis: 58 treated with BCS and 40 treated with MRM. The median age of the cohort was 53 years (range 35–70 years). Of the 200 potentially eligible women contacted, 102 did not participate, yielding a participation rate of 49.0%. Participant flow from contact through final analysis is shown in Figure 1, and the cohort characteristics from the source dataset are summarized in Table 1. Detailed clinicopathological comparability between the surgical groups could not be assessed.

On the EORTC QLQ-C30, all reported summary domains favored breast conservation (Table 2). The median functional score

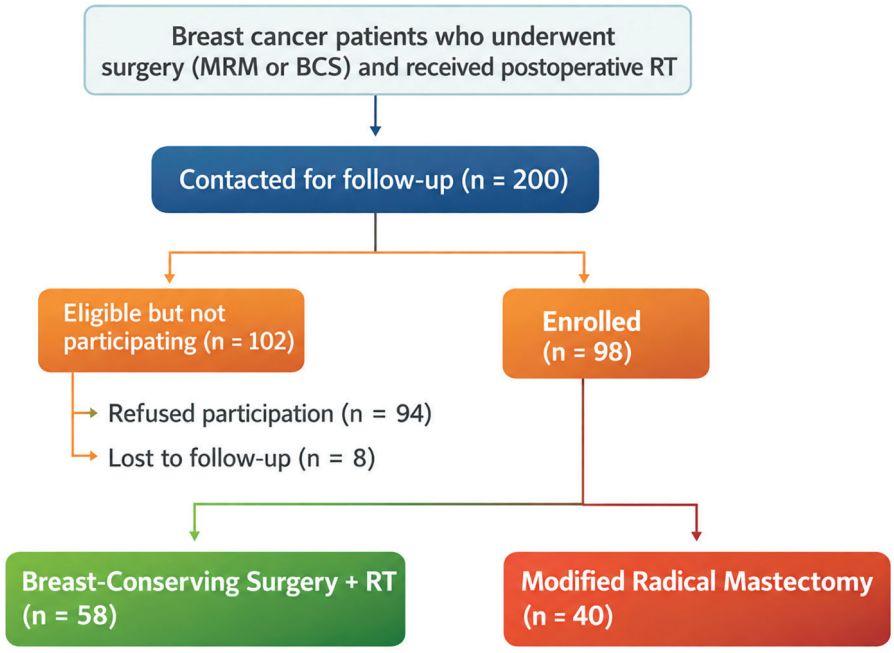

Figure 1. Participant flow diagram compatible with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. Flow diagram showing patient identification, participation, and final allocation to the BCS + RT and MRM + RT analytical groups

BCS: Breast conserving surgery; RT: Radiotherapy; MRM: Modified radical mastectomy

Table 1. Cohort characteristics and design features available from the source dataset

Variable	Overall cohort	Comment
Total analyzed participants	98	58 BCS + RT; 40 MRM + RT
Potentially eligible women contacted	200	102 did not participate
Participation rate	49.0%	Characteristics of non-participants were unavailable
Age	Median 53 years (range 35–70)	Group-specific descriptive data unavailable
Study design	Cross-sectional observational	Single-center tertiary hospital cohort

BCS: Breast conserving surgery; RT: Radiotherapy; MRM: Modified radical mastectomy

Table 2. Comparison of EORTC QLQ-C30 summary scores according to surgical approach

Domain	BCS + RT (*n* = 58)	MRM + RT (*n* = 40)	*p*-value
Functional score, median (min-max)	60.00 (11.11–93.33)	46.66 (6.67–91.11)	0.005
Symptom summary score*, median (min-max)	67.94 (28.21–97.44)	58.97 (33.33–89.74)	0.001
Global health status, median (min-max)	66.66 (0–100)	37.50 (1–75)	<0.001

*: Symptom summary scores were oriented so that higher values indicate lower symptom burden; BCS: Breast conserving surgery; RT: Radiotherapy; MRM: Modified radical mastectomy; EORTC: European Organisation for Research and Treatment of Cancer; QLQ-C30: Quality of Life Questionnaire-Core 30

was higher in the BCS group than in the MRM group (60.00 *vs.* 46.66; $p = 0.005$). Global health status showed the largest absolute between-group difference (66.66 *vs.* 37.50; $p<0.001$). The symptom summary score—oriented so that higher values represent lower symptom burden—was also higher in the BCS group (67.94 *vs.* 58.97; $p = 0.001$). These are unadjusted comparisons and likely reflect more favorable patient-reported scores in the BCS group, rather than indicating an independent effect of the surgical procedure.

Breast-cancer-specific quality of life findings followed the same pattern (Table 3). The BCS group reported higher functional

Table 3. Comparison of EORTC QLQ-BR23 summary scores according to surgical approach

Domain	BCS + RT (*n* = 58)	MRM + RT (*n* = 40)	*p*-value
Functional score, median (min-max)	57.77 (15.56–93.33)	44.44 (6.67–84.44)	0.008
Symptom summary score*, median (min-max)	87.50 (67.19–100)	84.38 (71.88–95.31)	0.045

*: Symptom summary scores were oriented so that higher values indicate lower symptom burden; BCS: Breast conserving surgery; RT: Radiotherapy; MRM: Modified radical mastectomy; EORTC: European Organisation for Research and Treatment of Cancer

scores than the MRM group on the QLQ-BR23 (57.77 *vs.* 44.44; $p = 0.008$). The BR23 symptom summary score was also higher in the BCS group (87.50 *vs.* 84.38; $p = 0.045$). The absolute difference in the symptom summary score was modest, and its clinical importance cannot be determined from the available summary data.

Exploratory correlations, which were not part of the primary between-group comparisons, are provided in Supplementary Table 1.

Discussion and Conclusion

In this cross-sectional observational study of women who completed postoperative RT after breast cancer surgery, BCS was associated with more favorable patient-reported quality of life scores than MRM across the general and breast-specific summary measures examined. The largest absolute difference was observed in QLQ-C30 global health status, while the direction of the unadjusted differences was consistent across functional and symptom summaries. Because baseline clinical comparability and the timing of questionnaire administration could not be assessed, these findings should not be interpreted as evidence that the surgical procedure itself caused the observed differences.

The observed differences are potentially relevant to counseling because the decision between BCS and mastectomy may be preference-sensitive when both approaches are oncologically appropriate. Patients may consider daily functioning, body image, symptoms, and perceived health alongside recurrence risk and margin-related outcomes. Accordingly, patient-reported survivorship outcomes merit consideration during shared decision-making, while the unadjusted nature of our comparisons should be made explicit.

The median QLQ-C30 global health status score differed by 29.16 points between groups. Although this numerical separation appears substantial, clinical importance cannot be established with confidence without adjusted analyses, domain-level results, and standardized information on the timing of assessment. The findings should also be interpreted within evolving surgical and radiation oncology practice, including changes in RT volumes and techniques (10, 11), wider use of oncoplastic breast conservation (12), immediate reconstruction, and de-escalated axillary surgery. These developments may limit the generalizability of a comparison restricted to BCS and MRM.

The current findings are broadly concordant with the long-term randomized and observational evidence that reshaped modern breast surgery. Fisher et al. (2) and Veronesi et al. (3) showed that BCS plus RT provides survival comparable to mastectomy in appropriately selected patients. In this context, quality of life is an important additional outcome. The present study provides institutional data showing that, among respondents who had received RT, patient-reported summary scores were more favorable in the BCS group; however, the study cannot isolate the effect of surgical extent from differences in patient selection and treatment.

Engel et al. (6) reported better long-term quality of life outcomes in selected domains after breast conserving therapy, and Arndt et al. (7) showed that quality of life differences may persist over years of survivorship. Ganz et al. (13) likewise emphasized that psychosocial concerns remain central long after acute treatment. Our results fit within this broader framework. Nevertheless, the differences observed in our cohort may reflect surgical extent, baseline disease burden, treatment intensity, reconstructive pathways, patient preference, or other unmeasured factors. The meta-analysis by Ng et al. (8) similarly found that BCS was associated with better body image and several quality of life domains than mastectomy.

Postmastectomy quality of life is heterogeneous rather than uniformly poor. Howes et al. (14), Hanson et al. (15), and Zehra et al. (16) showed that reconstruction may narrow some quality of life differences between mastectomy and breast conservation. Reconstruction status was not available in our dataset, so the MRM group could not be characterized as reconstructed or non-reconstructed. This prevents direct comparison of our findings with contemporary reconstruction-based mastectomy pathways and limits their generalizability.

Recent longitudinal data continue to support the importance of breast preservation where feasible. Gulis et al. (17) reported favorable health related quality of life outcomes after partial and oncoplastic partial mastectomy, while cross cultural studies by Kamińska et al. (18) similarly suggested better outcomes after breast-conserving treatment than after mastectomy in several domains. Deepa et al. (19), however, reported more comparable

long-term outcomes in another setting, underscoring that culture, timing of assessment, reconstructive access, and adjuvant treatment patterns can modify observed differences. Emiroğlu et al. (12) also emphasized that oncoplastic techniques can expand breast conservation while supporting oncologic and aesthetic goals. For this reason, institution-specific data remain valuable for counseling patients in the healthcare environment where the decision is made.

The similar direction of the QLQ-C30 and QLQ-BR23 summary findings supports their internal coherence; however, it does not overcome residual confounding or establish clinical significance.

The clinical implication of our study is not that MRM should be avoided when oncologically indicated. Potential differences in patient-reported outcomes should be discussed when BCS and mastectomy are both reasonable options. Surgical planning should consider oncologic safety, patient preferences, and anticipated survivorship outcomes.

Shared decision-making in breast surgery often emphasizes local control, margin management, risk of re-excision, and adjuvant therapy. These are essential topics, but they do not fully address how patients will live with the consequences of treatment.

In this post-RT cohort, breast preservation was associated with more favorable functioning scores and perceived health scores; however, the independent contributions of surgery, RT, and patient selection could not be separated.

The between-group difference in global health status also supports discussion of overall well-being rather than focusing only on isolated symptoms. A multidisciplinary counseling model may involve breast surgeons, radiation oncologists, nursing teams, and psycho-oncology support when available. Patients should be informed not only about oncologic eligibility for BCS but also about how different local treatment pathways may be associated with recovery, body image, arm symptoms, and daily life.

These findings illustrate that patient-reported treatment burden extends beyond oncologic outcomes, although the independent contribution of surgical extent to this burden could not be determined.

Study Limitations

This study has several strengths. It used two internationally validated instruments that together capture generic and breast-specific aspects of survivorship. It also restricted the analysis to women who completed postoperative RT, thereby reducing one broad source of treatment heterogeneity. The consistent direction of the QLQ-C30 and QLQ-BR23 summary findings supports their internal coherence, but does not overcome the limitations of the unadjusted observational comparison.

Nevertheless, the limitations are substantial and should inform the interpretation of the findings. First, the cross-sectional design cannot establish causality or temporal changes. Baseline quality of life was not measured, and the intervals from surgery completion and RT completion to questionnaire administration were unavailable. Second, the modest single-center cohort limits statistical power and external generalizability. Because no a priori sample size calculation was performed, non-significant findings cannot be assumed to demonstrate equivalence. Third, treatment allocation was not randomized and was likely influenced by tumor extent, nodal involvement, multifocality, clinical indication, and patient preference. These characteristics were not available for group-level comparison or adjustment. Confounding by indication and residual confounding are, therefore, major limitations.

Fourth, only 98 (49.0%) of the 200 women contacted participated, and characteristics of non-participants were unavailable; therefore, the direction and magnitude of non-response bias cannot be assessed. Fifth, information on receptor and molecular subtype, neoadjuvant and adjuvant systemic treatments, endocrine and HER2-directed therapy, axillary surgery, reconstruction, menopausal status, body mass index, complications, and lymphedema was unavailable. Sixth, RT technique, target volumes, regional nodal irradiation, boost use, dose, and fractionation were not captured in a standardized, patient-level form. This is important because RT volumes have been associated with late cosmetic and quality of life outcomes after BCS (10), and contemporary RT approaches may alter toxicity profiles (11). Seventh, domain-level EORTC results, including body image, emotional and sexual functioning, future perspective, breast and arm symptoms, were unavailable. This limits assessment of both the source and the clinical importance of the differences in summary scores. Finally, symptom summaries were reverse-scored so that higher scores indicated lower symptom burden; this scoring direction is documented in the Methods and in the table footnotes.

Accordingly, the results should be regarded as exploratory, unadjusted associations that require confirmation in clinically characterized longitudinal cohorts.

Future studies should adopt prospective longitudinal designs with preoperative baselines and repeated postoperative measurements. They should distinguish among BCS plus RT, mastectomy alone, mastectomy with immediate reconstruction, and mastectomy with delayed reconstruction, while accounting for clinicopathological characteristics, axillary surgery, RT parameters, systemic therapy, complications, and socioeconomic context. Propensity-based comparative analyses may be useful when randomized trials are impractical. Incorporating validated patient-reported outcome measures into routine follow-up could also improve survivorship counseling.

In this post-RT cohort, women in the BCS group reported more favorable quality of life summary scores than women in the MRM group. These unadjusted associations do not establish an independent effect of surgical approach, but support the inclusion of patient-reported survivorship outcomes in shared surgical decision-making.

Ethics

Ethics Committee Approval: The study protocol was approved by the University of Health Sciences Türkiye, Ümraniye Training and Research Hospital Scientific Research Ethics Committee (approval no: 83, date: March 28, 2024).

Informed Consent: All participants provided informed consent before questionnaire administration.

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For transparency, the authors note that an artificial intelligence-assisted language model (ChatGPT, OpenAI) was utilized to support text editing and language correction. This assistance was limited to linguistic refinement; all scientific content, critical analysis, and final editorial decisions were made exclusively by the authors.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Ş.Ö., H.K., K.T., F.B., F.E.; Concept: H.K.T., H.K., K.T., F.B., F.E.; Design: H.K.T., H.K., K.T., F.B., F.E.; Data Collection and/or Processing: S.A., H.K., M.K., P.A., C.K., B.G., F.E.Y.; Analysis and/or Interpretation: S.A., H.K., M.K., P.A., C.K., B.G., F.E.Y.; Literature Search: H.K.T., Ş.Ö., H.K., M.K., P.A., C.K., B.G., F.E.Y., K.T., F.B., F.E.; Writing: H.K.T., Ş.Ö., H.K., F.E.

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Supplementary Material Table 1: https://d2v96fxpocvxx.cloudfront.net/beb8919b-f013-4ea1-b1c8-40332e840fe1/content-images/6d34b63e-49c7-49fb-bbd8-6c15eee4ef76.pdf

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