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# Impact of conservative, radical, and oncoplastic surgery on the quality of life of women with breast cancer

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## ABSTRACT

**Introduction:** Health-related quality of life (HRQoL) has become a key outcome in evaluating breast cancer patients, influencing treatment decisions and long-term prognosis. Different surgical approaches and adjuvant therapies may significantly impact various HRQoL domains, including physical, emotional, and social well-being. This study aimed to assess HRQoL in public sector employees undergoing surgical treatment for breast cancer, comparing different surgical approaches (conservative, radical, and oncoplastic) and analyzing the impact of chemotherapy and radiotherapy on HRQoL outcomes. **Methods:** This was a cross-sectional, observational study conducted at Hospital do Servidor Público Estadual de São Paulo (HSPE) between 2021 and 2024. A total of 600 female patients diagnosed with non-metastatic breast cancer who underwent surgical treatment were included. HRQoL was assessed using the validated EORTC QLQ-C30 and QLQ-BR23 questionnaires. Statistical analyses included ANOVA and multivariate regression models, adjusting for confounding variables. **Results:** Patients who underwent conservative surgery had significantly better HRQoL scores compared to those undergoing oncoplastic or radical surgery. Surprisingly, oncoplastic surgery was associated with lower global HRQoL (β=-16.27; p=0.003), cognitive function (β=-22.34; p<0.001), and social function (β=-19.15; p<0.001). Chemotherapy was linked to persistent cognitive impairment and increased systemic side effects. The mean body image score was highest in the conservative surgery group (80.9) compared to mastectomy (45.8; p=0.003). Common symptoms included fatigue, pain, and insomnia. **Conclusions:** Surgical approach plays a crucial role in HRQoL outcomes for breast cancer patients. Contrary to expectations, oncoplastic techniques were associated with worse quality of life scores, highlighting the need for personalized treatment decisions. Chemotherapy had a significant negative impact on cognitive function and symptom burden. These findings emphasize the importance of incorporating HRQoL assessments in clinical practice to optimize patient-centered treatment strategies and postoperative rehabilitation.

KEYWORDS: breast cancer, health-related quality of life, oncoplastic surgery, chemotherapy, patient-centered care.

## INTRODUCTION

Health-related quality of life (HRQoL) has become a fundamental outcome in modern oncology, crucial for assessing the physical, emotional, and social impact of breast cancer (BC) from the patients' perspective[1-3]. This approach goes beyond traditional survival metrics, assisting in the choice of individualized therapeutic strategies.

BC is the most common malignant neoplasm in women in Brazil and worldwide, excluding cases of non-melanoma skin cancer. In Brazil, the estimate for the 2023–2025 triennium points to 73,610 new cases annually, with an incidence rate of 66.54 occurrences per 100,000 women[4]. Globally, data from the Global Cancer Observatory (GLOBOCAN) indicate more than 2.5 million new cases and approximately 685,000 deaths in 2022, consolidating BC as the leading cause of cancer death in women in 143 countries[5].

The sequelae of cancer treatment profoundly impact patients' lives, extending beyond the physical sphere. Studies report that

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up to 60% of female BC survivors experience impairment in at least one domain of HRQoL, of which 25% report impairment in multiple domains, even five years after diagnosis[6-8]. Among the most prevalent changes are fatigue, chronic pain, cognitive dysfunction, and insomnia[5,9].

Conservative, radical, and oncoplastic surgeries differ not only in their oncological and aesthetic implications, but also in their potential to affect psychosocial dimensions of HRQoL. While conservative and some oncoplastic techniques seek to preserve body image and reduce emotional impact, mastectomies and more invasive surgeries often result in a worse perception of physical well-being and self-image[10,11]. Although the literature suggests aesthetic advantages with oncoplasty, recent studies question the uniformity of these benefits in all contexts[11,12].

In addition, adjuvant therapies such as chemotherapy and hormone therapy contribute significantly to the impairment of HRQoL, especially in relation to cognitive function and the burden of systemic adverse effects [13,14]. It is estimated that up to 75% of patients undergoing hormone therapy report toxicities that negatively affect their quality of life[13].

Given this scenario, it is imperative to understand how the various surgical approaches, alone or in combination with adjuvant therapies, influence patients' perceptions of their health and well-being. Thus, this study aimed to evaluate HRQoL in female civil servants who underwent different surgical modalities for the treatment of BC, as well as to examine the influence of chemotherapy and radiotherapy on the main domains of HRQoL.

# METHODS

## Study design

This is an observational, descriptive, cross-sectional, single-institution study that assessed HRQoL in female state civil servants with BC who underwent surgical treatment at the Hospital do Servidor Público Estadual (HSPE) from October 2021 to December 2024.

## Population and sample

### *Target population*

The target population of this study included female state civil servants in the state of São Paulo with non-metastatic BC who underwent surgical treatment at the HSPE from October 2021 to December 2024. The patients were identified through the surgical list of the breast pathology sector and the evaluation of electronic medical records.

### *Inclusion criteria*

Female patients over the age of 18 diagnosed with breast cancer (***in situ*** or invasive carcinoma) and undergoing surgical treatment were included in the study. All participants were state civil servants in the state of São Paulo treated at HSPE.

### *Exclusion criteria*

Patients who did not agree to answer the questionnaire were excluded from the study, as well as those with metastatic BC at the time of the study or who developed metastatic disease within six months of diagnosis.

## Data collection procedures

Patients selected for surgery were invited to participate in the study by telephone. After confirming their interest, each patient was sent the informed consent form (ICF) and a questionnaire to be completed on the Google Forms platform by email.

Clinical data and clinical-pathological characteristics of BC were collected from the HSPE breast pathology department's own database, supplemented with information from the electronic medical record (MV PEP).

### *Analyzed variables*

The variables studied were categorized into three main groups: sociodemographic and clinical data and disease characteristics. Sociodemographic data included age (date of birth), race (self-reported skin color), number of children, education, and marital status (including stable union). Regarding clinical data, information on comorbidities presented by the patients was collected. Regarding disease characteristics, the anatomopathological examination of the biopsy and surgical specimen, immunohistochemistry results, HER-2 gene amplification testing by *in situ* hybridization (when indicated), and clinical staging were evaluated. The treatments performed were also recorded, including the type of surgical approach (conservative, radical, or oncoplastic), chemotherapy (neoadjuvant or adjuvant), radiotherapy, use of endocrine therapy, and application of targeted drugs.

The oncoplastic techniques used in the present study were exclusively therapeutic mammoplasty (volume displacement), with resection of the tumor segment and glandular remodeling by means of reduction mammoplasty. The pedicles used for transposition of the nipple-areola complex varied according to tumor location, with the most frequently used being the inferior pedicle (tumors in the upper quadrants), the superior pedicle (tumors in the lower quadrants), and, less frequently, the superomedial pedicle. In all cases, contralateral symmetrization was performed during the same surgical procedure. No patient underwent *volume* replacement techniques, reconstruction with myocutaneous flaps, or implants.

## Quality of life assessment instruments

Quality of life was assessed using two instruments validated for the Brazilian population: the European Organization for Research and Treatment of Cancer 30-Item Quality of Life Questionnaire

(EORTC QLQ-C30)[15-17], version 3.0, and its specific module for breast cancer (QLQ-BR23)[15-17].

The EORTC QLQ-C30 contains 30 items distributed across three main scales:

- Global Health Scale (QL2): general assessment of health and quality of life;
- Functional scales: physical function, role performance, cognitive, emotional, and social function;
- Symptom scale: fatigue, pain, nausea/vomiting, and other physical symptoms.

The QLQ-BR23 complements the assessment with 23 items specific to BC, divided into:

- Functional scale: body image, sexual function, sexual satisfaction, and future prospects;
- Symptom scale: side effects of therapy, breast and arm-related symptoms, and hair loss.

The scores for both questionnaires were calculated according to the EORTC Scoring Manual (2001), with linear transformation to a scale of 0 to 100 points. On the functional and overall health scales, higher scores indicate better quality of life. On the symptom scales, higher scores indicate greater symptom intensity and, consequently, poorer quality of life.

Authorization to use the instruments was obtained directly from the EORTC.

## Statistical analyses

Categorical variables were presented as absolute and relative frequencies, and continuous variables as mean, standard deviation, median, and minimum and maximum values. To compare quality of life scores in the three types of surgery, analysis of variance (ANOVA) was used with a significance level of $p<0.05$. Multivariate analysis was performed by linear regression, including the type of surgery, radiotherapy, and chemotherapy as predictors. Variables with $p<0.2$ in the univariate analysis were selected for multivariate analysis. The results were presented as beta coefficients ($\beta$), with 95% confidence intervals (CI). SPSS *software* was used for the analyses.

## Ethical aspects

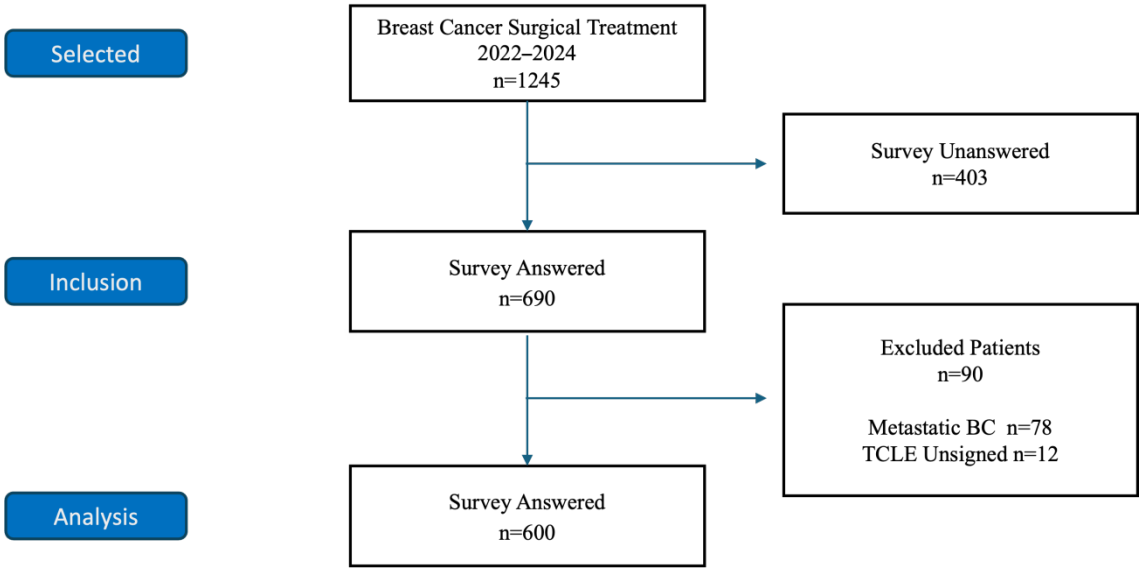
The study was submitted through the Brazil Platform to the Research Ethics Committee of Hospital do Servidor Público Estadual Francisco Morato de Oliveira and approved under number CAAE 68337823.4.0000.5463. All patients included in the study signed the ICF.

# RESULTS

During the study period (2021–2024), 1,093 patients undergoing surgical treatment for BC were identified at the Hospital do Servidor Público Estadual. Of these, 403 (36.9%) did not respond to the invitation to participate in the study. The 690 (63.1%) patients who initially agreed to participate responded to the questionnaire sent to them.

After applying the exclusion criteria, 90 patients (13.0% of respondents) were removed from the study, among whom 78 (86.7%) had metastatic disease and 12 (13.3%) did not sign the ICF.

The final sample analyzed consisted of 600 patients, representing 54.9% of the total number of initially eligible patients and 87.0% of those who responded to the questionnaire (Figure 1).




BC: *breast cancer*; TCLE: Termo de Consentimento Livre e Esclarecido (Informed Consent Form).
**Figure 1.** Flowchart of participant selection for the study.

## Sociodemographic characteristics of the study population

The sample was well distributed among age groups: 18 to 49 years (34.5%), 50 to 69 years (32.3%), and ≥70 years (33.2%). Most patients identified themselves as mixed-race (27.2%) or black (23.8%). Most participants had high school education (76.5%) and at least one comorbidity (52.7%).

Regarding tumor characteristics, the distribution of molecular subtypes was balanced: luminal A (19.5%), luminal B (22.0%), luminal HER2 (20.8%), HER2 positive (24.0%), and triple-negative (13.7%). Clinical staging ranged from stage 0 (19.5%) to stage III (27.5%).

Regarding surgical modalities, 31.8% underwent conservative surgery, 31.2% underwent oncoplastic surgery, and 37.0% underwent mastectomy without reconstruction. An axillary approach was performed in 100% of patients, with 37.5% undergoing sentinel lymph node biopsy (SLNB) alone and 62.5% undergoing combined procedures with lymphadenectomy.

Adjuvant therapies were widely used, with chemotherapy in 75.0% of patients (38.8% neoadjuvant and 36.2% adjuvant), radiotherapy in 70.5%, and hormone therapy in 73.8%.

The $\chi^2$test did not identify significant associations between sociodemographic variables and return to work (p>0.05). Detailed results are presented in Table 1.

## Analysis of the EORTC QLQ-C30 and QLQ-BR23 quality of life questionnaires

The results of the EORTC QLQ-C30 and QLQ-BR23 instruments are presented in Table 2. The mean overall quality of life score (QL2) was 70.6 (SD=19.2). Physical (76.6), role (78.3), cognitive (77.0), and social (87.1) functions had high scores, whereas emotional function had the lowest mean (65.1).

Among the most prevalent symptoms, insomnia (33.3), pain (30.0), and fatigue (28.3) stood out. Nausea/vomiting (5.7) and dyspnea (7.2) had low scores.

The QLQ-BR23 module revealed high scores for sexual function (82.5) and body image (74.9), whereas future prospects had the lowest score among the functions evaluated (47.3). Arm-related symptoms (25.2) and breast symptoms (22.4) were also observed with moderate intensity. Hair loss was one of the most frequently reported symptoms (35.9).

Supplementary Table 1 presents a comparison of the main clinical and therapeutic variables between the three surgical groups. No statistically significant differences were observed between the groups in terms of race, marital status, education, comorbidities, molecular subtype, clinical staging, lymph node status, or use of adjuvant therapies (chemotherapy and radiotherapy), with the exception of the variable age ≥70 years, which was significantly more prevalent in the group undergoing mastectomy (p<0.001).

In order to identify factors associated with the choice of surgical approach, we performed univariate analysis (Supplementary Table 2) and then multivariate analysis (Supplementary Table 3), including all variables with p<0.20 in the logistic regression. In the univariate analysis, variables such as age ≥70 years (OR: 2.1; 95%CI: 1.4–3.1; p<0.001) and tumor ≥T2 (OR 1.8; 95%CI 1.1–2.8; p=0.014) showed a significant association with more extensive surgeries (oncoplastic or radical). In the multivariate analysis, only these two variables remained significantly associated with the type of surgery, with age ≥70 years presenting an adjusted OR of 2.4 (95% CI 1.5–3.8; p<0.001) and tumor ≥T2 with an adjusted OR of 1.7 (95% CI 1.1–2.7; p=0.014).

## Univariate analysis of quality of life and type of surgery

Univariate analysis of quality of life scores according to type of surgery (conservative, oncoplastic, and radical) (Table 3) revealed statistically significant differences in several domains.

The overall health score (QL2) was higher in conservative surgery (mean=73.2) than in the oncoplastic (55.2) and radical (66.7) groups (p=0.033). In cognitive function (CF), the oncoplastic group had the lowest scores (56.3) compared to the conservative (79.5) and radical (78.3) groups (p=0.045). Social function (SF) was also higher in conservative surgery (90.7) than in the radical (78.3) and oncoplastic (70.8) groups (p=0.017).

In the QLQ-BR23 module, body image (BRBI) had the worst score in the radical group (45.8), followed by the oncoplastic (65.6) and conservative (80.9) groups (p=0.003). Side effects of systemic therapy (BRST) were more intense in the oncoplastic group (32.1) than in the radical (20.5) and conservative (16.4) groups (p=0.019). Symptoms in the arm (BRAS) were more frequent in the oncoplastic group (44.4) (p=0.050).

There were no significant differences in other domains, such as physical function (PF2), role performance (RF2), and emotional function (EF). The findings indicate that conservative surgery is associated with better quality of life, while oncoplastic surgery, contrary to expectations, was associated with greater impairment in some aspects, such as arm symptoms and side effects of systemic therapy.

## Multivariate analysis for type of surgery and radiotherapy and chemotherapy

The multivariate analysis of quality of life domains with significant differences in the univariate analysis (Table 4) included type of surgery, radiotherapy, and chemotherapy as predictor variables.

Oncoplastic surgery was independently associated with worse scores for overall quality of life (QL2) (β=-16.27; p=0.003) and cognitive function (CF) (β=-22.34; p<0.001), while radical surgery had no significant impact on these domains. Chemotherapy was associated with cognitive impairment (β=-8.96; p=0.027).

In social function (SF), both oncoplastic surgery (β=-19.15; p<0.001) and radical surgery (β=-11.23; p=0.031) had a negative impact. The body image domain was more compromised after

**Table 1.** Characterization of patients included in the study.

| Variables/Categories | Total | p-value |
|---|---|---|
| | n (%)<br>600 (100) | $\chi^2$ |
| Age group (years) | | |
| 18–49 | 207 (34.5) | 0.812 |
| 50–69 | 194 (32.3) | |
| >70 | 199 (33.2) | |
| Ethnicity | | |
| Asian | 152 (25.3) | 0.623 |
| White | 142 (23.7) | |
| Mixed-race | 163 (27.2) | |
| Black | 143 (23.8) | |
| Marital *status* | | |
| Married | 164 (27.3) | 0.455 |
| Divorced | 150 (25.0) | |
| Single | 138 (23.0) | |
| Common-law marriage | 148 (24.7) | |
| Number of children | | |
| None | 141 (23.5) | 0.533 |
| One | 164 (27.3) | |
| Two | 153 (25.5) | |
| >3 | 142 (23.7) | |
| Do you have any children under the age of 18? | | |
| No | 328 (54.7) | 0.328 |
| Yes | 272 (45.3) | |
| Schooling | | |
| Illiterate | 160 (26.7) | 0.675 |
| Elementary education | 142 (23.7) | |
| High School | 157 (26.2) | |
| Higher education | 141 (23.5) | |
| Comorbidities | | |
| No | 284 (47.3) | 0.412 |
| Yes | 316 (52.7) | |
| Public employment and profession | | |
| Education: administrative | 157 (26.2) | 0.487 |
| Education: teachers | 164 (27.3) | |
| Sector | | |
| Health: administrative | 138 (23.0) | |
| Health: nursing technician/assistant | 141 (23.5) | |
| Clinical stage (TNM) | | |
| 0 | 117 (19.5) | 0.352 |
| I | 167 (27.8) | |
| II | 151 (25.2) | |
| III | 165 (27.5) | |

Continue...

**Table 1.** Continuation.

| Variables/Categories | Total | p-value |
|---|---|---|
| | n (%)<br>600 (100) | $\chi^2$ |
| Tumor size (T) | | |
| Tis | 117 (19.5) | 0.483 |
| T1 | 128 (21.3) | |
| T2 | 128 (21.3) | |
| T3 | 121 (20.2) | |
| T4 | 106 (17.7) | |
| Lymph nodes | | |
| 0 | 208 (34.7) | 0.265 |
| N1 | 220 (36.7) | |
| N2 | 172 (28.7) | |
| N | 0 | |
| Molecular subtype | | |
| Luminal A | 117 (19.5) | 0.421 |
| Luminal B | 132 (22.0) | |
| Luminal HER-2 | 125 (20.8) | |
| HER-2 | 144 (24.0) | |
| TNBC | 82 (13.7) | |
| Type of surgery | | |
| Conservative | 191 (31.8) | 0.534 |
| Conservative with oncoplastic technique | 187 (31.2) | |
| Mastectomy without reconstruction | 222 (37.0) | |
| Axillary surgery | | |
| BLS | 225 (37.5) | 0.387 |
| BLS+EA | 241 (40.2) | |
| EA | 134 (22.3) | |
| Chemotherapy | | |
| Neoadjuvant | 233 (38.8) | 0.312 |
| Adjuvants | 217 (36.2) | |
| None | 150 (25.0) | |
| Anti-HER-2 therapy | | |
| Yes | 269 (44.3) | 0.645 |
| No | 331 (55.7) | |
| Radiotherapy | | |
| Yes | 423 (70.5) | 0.578 |
| No | 177 (29.5 | |
| Hormone therapy | | |
| Adjuvant | 214 (35.7) | 0.456 |
| Neoadjuvant | 229 (38.2) | |
| None | 157 (26.2) | |

χ2: chi-square test; SLNB: sentinel lymph node biopsy; AX: axillary dissection.

**Table 2.** Descriptive data relating to the complete results on the EORTC QLC-C30 and QLC-BR23 scales.

| | | Mean | Median | Standard deviation | CV | Q1 | Q3 | IQR | Min | Max | CI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QLQ-C30 | | | | | | | | | | | |
| Global | Overall quality of life (QL2) | 70.6 | 66.7 | 19.2 | 27 | 58.3 | 83.3 | 25.0 | 25.0 | 100.0 | 4.2 |
| Function | Physical function (PF2) | 76.6 | 80.0 | 18.6 | 24 | 66.7 | 93.3 | 26.7 | 26.7 | 100.0 | 4.1 |
| | Daily function (RF2) | 78.3 | 83.3 | 26.9 | 34 | 66.7 | 100.0 | 33.3 | 0 | 100.0 | 5.9 |
| | Cognitive function (CF) | 77.0 | 83.3 | 25.1 | 33 | 66.7 | 100.0 | 33.3 | 0 | 100.0 | 5.5 |
| | Emotional function (EF) | 65.1 | 66.7 | 25.8 | 40 | 50.0 | 83.3 | 33.3 | 0 | 100.0 | 5.7 |
| | Social function (SF) | 87.1 | 100.0 | 21.5 | 25 | 66.7 | 100.0 | 33.3 | 0 | 100.0 | 4.7 |
| Symptoms | Dyspnea (DY) | 7. | 0 | 15.7 | 219 | 0 | 0. | 0 | 0.0 | 66.7 | 3.5 |
| | Pain (PA) | 30. | 16.7 | 28.9 | 97 | 0 | 50 | 50.0 | 0 | 100.0 | 6.4 |
| | Fatigue (FA) | 28.3 | 33.3 | 21 | 74 | 11.1 | 33.3 | 22.2 | 0 | 77.8 | 4.6 |
| | Insomnia (SL) | 33.3 | 33.3 | 32.0 | 96 | 0 | 50.0 | 50.0 | 0 | 100.0 | 7.1 |
| | Loss of appetite (AP) | 11.0 | 0. | 19.8 | 180 | 0 | 33.3 | 33.3 | 0 | 66.7 | 4.4 |
| | Nausea and vomiting (NV) | 5.7 | 0. | 13.3 | 234 | 0.0 | 0. | 0 | 0.0 | 66.7 | 2.9 |
| | Constipation (CO) | 16.5 | 0. | 27.7 | 16 | 0. | 33.3 | 33.3 | 0 | 100.0 | 6.1 |
| | Diarrhea (DI) | 8. | 0. | 19.4 | 242 | 0.0 | 0. | 0 | 0.0 | 100.0 | 4.3 |
| | Financial difficulties (FI) | 15.6 | 0. | 25.5 | 163 | 0. | 33.3 | 33.3 | 0 | 100.0 | 5.6 |
| QLQ-BR23 | | | | | | | | | | | |
| Function | Body image (BRBI) | 74.9 | 91.7 | 32.0 | 43 | 58.3 | 100.0 | 41.7 | 0 | 100.0 | 7.0 |
| | Future outlook (BRFU) | 47.3 | 33. | 36.8 | 78 | 0 | 66.7 | 66.7 | 0 | 100.0 | 8.1 |
| | Sexual function (BRSEF) | 82.5 | 83.3 | 18.5 | 22 | 66.7 | 100.0 | 33.3 | 33.3 | 100.0 | 4.1 |
| | Sexual pleasure (BRSEE) | 57.4 | 66.7 | 27.2 | 47 | 33.3 | 66.7 | 33.3 | 0 | 100.0 | 8.9 |
| Symptoms | Side effects of systemic therapy (BRST) | 18.5 | 19.0 | 15.3 | 82 | 4.8 | 28.6 | 23.8 | 0.0 | 57.1 | 3.4 |
| | Breast symptoms (BRHL) | 35.9 | 33.3 | 30.0 | 84 | 0 | 66.7 | 66.7 | 0 | 100.0 | 9.4 |
| | Symptoms in the arm (BRAS) | 25.2 | 22.2 | 23.9 | 95 | 5.6 | 33.3 | 27.8 | 0 | 100.0 | 5.3 |
| | Anxiety due to hair loss (BRBS) | 22.4 | 16.7 | 21.6 | 97 | 8.3 | 33.3 | 25.0 | 0 | 100.0 | 4.8 |

CV: coefficient of variation; Q1: 1st quartile; Q3: 3rd quartile; IQR: interquartile range; CI: confidence interval.

radical surgery (β=-34.27; p<0.001) and, to a lesser extent, oncoplastic surgery (β=-14.52; p=0.046), with a tendency to worsen with chemotherapy (β=-8.73; p=0.061).

The side effects of systemic therapy (BRST) were more intense in the oncoplastic group (β=15.23; p<0.001) and after chemotherapy (β=12.45; p<0.001). Arm symptoms (BRAS) were associated with oncoplastic surgery (β=21.38; p<0.001) and radiotherapy (β=7.92; p=0.017).

The findings reinforce the impact of the type of surgery on quality of life, with greater impairment in oncoplastic techniques, contrary to theoretical expectations of benefit.

## Analysis of the interaction between age group and type of surgery

Analysis of the interaction between age group and type of surgery revealed a consistent pattern of modification of the effect of surgical approaches as a function of age (Figure 2).

In terms of overall quality of life (QL2), a significant interaction was identified (p=0.038), with a progressive reduction in scores as age increased in all surgical groups, with the most pronounced decline in the oncoplastic group. Conservative surgery showed a slight decrease of 8.1 points between the extreme age groups (from 77.4 to 69.3 points), while oncoplastic surgery showed a decrease of 17.6 points (from 65.2 to 47.6 points). The difference between these two approaches widened from 12.2 points in the 18-49 age group to 21.7 points in the ≥70 age group, demonstrating the modulating effect of age on overall quality of life.

In the domain of cognitive function (CF), the interaction was even more evident (p=0.042). The scores of patients undergoing conservative and radical surgery remained relatively stable across age groups, in contrast to the marked decline observed in the oncoplastic group with increasing age. In patients aged 70 years or older, oncoplastic surgery resulted in a mean score of 41.7 (95%CI: 27.4–56.0), significantly lower than the scores obtained for conservative surgery (73.1; 95%CI: 63.9–82.3) and radical surgery (70.9; 95%CI: 58.3–83.5) in the same age group. The difference between conservative and oncoplastic surgery in this domain increased from 16.7 points in the 18–49 age group to 31.4 points in the ≥70 age group.

**Table 3.** Univariate analysis for type of surgical treatment for EORTC-QLQ-C30 and QLQ-BR23 scores.

| | | | Mean | Median | Standard deviation | CV (%) | Min | Max | N | CI | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QLQ-C30 | | | | | | | | | | | |
| Global | Overall quality of life (QL2) | Conservative | 73.2 | 66.7 | 17.6 | 24 | 33.3 | 100.0 | 187 | 4.4 | 0.033 |
| | | Radical | 55.2 | 58.3 | 19.4 | 35 | 25.0 | 83.3 | 222 | 13.4 | |
| | | Oncoplastic | 66.7 | 66.7 | 23.6 | 35 | 25.0 | 100.0 | 191 | 14.6 | |
| Function | Physical function (PF2) | Conservative | 76.3 | 80.0 | 18.7 | 25 | 26.7 | 100.0 | 187 | 4.7 | 0.933 |
| | | Radical | 76.7 | 80.0 | 19.5 | 25 | 53.3 | 100.0 | 222 | 13.5 | |
| | | Oncoplastic | 78.7 | 83.3 | 18.8 | 24 | 40.0 | 100.0 | 191 | 11.7 | |
| | Daily function (RF2) | Conservative | 79.5 | 100.0 | 27.8 | 35 | 0 | 100.0 | 187 | 7 | 0.441 |
| | | Radical | 66.7 | 66.7 | 23.6 | 35 | 33.3 | 100.0 | 22 | 16.3 | |
| | | Oncoplastic | 80.0 | 83.3 | 23.3 | 29 | 33.3 | 100.0 | 191 | 14.4 | |
| | Cognitive function (CF) | Conservative | 79.5 | 83.3 | 24.4 | 31 | 0 | 100.0 | 187 | 6.1 | 0.045 |
| | | Radical | 56.3 | 66.7 | 21.7 | 39 | 16.7 | 83.3 | 222 | 15 | |
| | | Oncoplastic | 78.3 | 91.7 | 26.1 | 33 | 33.3 | 100.0 | 191 | 16.2 | |
| | Emotional function (EF) | Conservative | 66.4 | 75.0 | 26.7 | 40 | 0 | 100.0 | 187 | 6.7 | 0.389 |
| | | Radical | 53.1 | 45.8 | 24.0 | 45 | 25.0 | 100.0 | 222 | 16.6 | |
| | | Oncoplastic | 66.7 | 70.8 | 20.4 | 31 | 25.0 | 100.0 | 191 | 12.7 | |
| | Social function (SF) | Conservative | 90.7 | 100.0 | 20.8 | 23 | 0.0 | 100.0 | 187 | 5.2 | 0.017 |
| | | Radical | 70.8 | 66.7 | 19.4 | 27 | 50.0 | 100.0 | 222 | 13.5 | |
| | | Oncoplastic | 78.3 | 75.0 | 20.9 | 27 | 50.0 | 100.0 | 191 | 12.9 | |
| Symptoms | Dyspnea (DY) | Conservative | 6. | 0. | 15.9 | 242 | 0.0 | 66.7 | 187 | 4.0 | 0.065 |
| | | Radical | 0 | 0 | 0 | - | 0. | 0. | 222 | - x - | |
| | | Oncoplastic | 16.7 | 16.7 | 17.6 | 105 | 0 | 33.3 | 191 | 10.9 | |
| | Dor (PA) | Conservative | 29.5 | 16.7 | 29.1 | 99 | 0 | 100.0 | 187 | 7.3 | 0.268 |
| | | Radical | 43.8 | 41.7 | 30.8 | 70 | 0 | 100.0 | 222 | 21.3 | |
| | | Oncoplastic | 21.7 | 16.7 | 24.9 | 115 | 0 | 66.7 | 191 | 15.4 | |
| | Fatigue (FA) | Conservative | 27 | 22.2 | 21.0 | 78 | 0 | 77.8 | 187 | 5.3 | 0.412 |
| | | Radical | 37.5 | 33.3 | 16.7 | 45 | 11.1 | 66.7 | 222 | 11.6 | |
| | | Oncoplastic | 28.9 | 33.3 | 23.5 | 81 | 0 | 66.7 | 191 | 14.6 | |
| | Insomnia (SL) | Conservative | 33.3 | 33.3 | 31.6 | 95 | 0 | 100.0 | 187 | 7.9 | 0.620 |
| | | Radical | 41.7 | 33.3 | 34.5 | 83 | 0 | 100.0 | 222 | 23.9 | |
| | | Oncoplastic | 26.7 | 16.7 | 34.4 | 129 | 0 | 100.0 | 191 | 21.3 | |
| | Loss of appetite (AP) | Conservative | 9.8 | 0. | 19.6 | 19 | 0.0 | 66.7 | 187 | 4.9 | 0.611 |
| | | Radical | 16.7 | 16.7 | 17.8 | 107 | 0 | 33.3 | 222 | 12.3 | |
| | | Oncoplastic | 13.3 | 0 | 23.3 | 175 | 0.0 | 66.7 | 191 | 14.4 | |
| | Nausea and vomiting (NV) | Conservative | 5.2 | 0. | 13.5 | 259 | 0.0 | 66.7 | 187 | 3.4 | 0.101 |
| | | Radical | 14.6 | 8.3 | 16.5 | 113 | 0. | 33.3 | 222 | 11.4 | |
| | | Oncoplastic | 1.7 | 0. | 5.3 | 316 | 0.0 | 16.7 | 191 | 3.3 | |
| | Constipation (CO) | Conservative | 16.4 | 0.0 | 27.6 | 169 | 0.0 | 100.0 | 187 | 6.9 | 0.999 |
| | | Radical | 16.7 | 16.7 | 17.8 | 107 | 0 | 33.3 | 222 | 12.3 | |
| | | Oncoplastic | 16.7 | 0 | 36.0 | 216 | 0. | 100.0 | 191 | 22.3 | |
| | Diarrhea (DI) | Conservative | 7 | 0. | 16.2 | 229 | 0.0 | 66.7 | 187 | 4.1 | 0.721 |
| | | Radical | 12.5 | 0 | 24.8 | 198 | 0. | 66.7 | 222 | 17.2 | |
| | | Oncoplastic | 10 | 0 | 31.6 | 316 | 0 | 100.0 | 191 | 19.6 | |
| | Financial difficulties (FI) | Conservative | 13. | 0 | 24.6 | 180 | 0.0 | 100.0 | 187 | 6.2 | 0.425 |
| | | Radical | 25 | 16.7 | 29.5 | 118 | 0 | 66.7 | 222 | 20.5 | |
| | | Oncoplastic | 20 | 0 | 28.1 | 141 | 0 | 66.7 | 191 | 17.4 | |

Continue...

**Table 3.** Continuation.

| | | | Mean | Median | Standard deviation | CV (%) | Min | Max | N | CI | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QLQ-BR23 | | | | | | | | | | | |
| Function | Body image (BRBI) | Conservative | 80.9 | 91.7 | 27.4 | 34 | 0 | 100.0 | 187 | 6.9 | 0.003 |
| | | Radical | 65.6 | 62.5 | 32.3 | 49 | 16.7 | 100.0 | 222 | 22.4 | |
| | | Oncoplastic | 45.8 | 58.3 | 42.4 | 92 | 0 | 100.0 | 191 | 26.3 | |
| | Future outlook (BRFU) | Conservative | 50.8 | 66.7 | 36.3 | 71 | 0 | 100.0 | 187 | 9.1 | 0.095 |
| | | Radical | 20.8 | 0 | 30.5 | 147 | 0. | 66.7 | 222 | 21.2 | |
| | | Oncoplastic | 46.7 | 50.0 | 39.1 | 84 | 0 | 100.0 | 191 | 24.3 | |
| | Sexual function (BRSEF) | Conservative | 84.2 | 83.3 | 18.1 | 22 | 33.3 | 100.0 | 187 | 4.5 | 0.246 |
| | | Radical | 72.9 | 83.3 | 15.3 | 21 | 50.0 | 83.3 | 222 | 10.6 | |
| | | Oncoplastic | 80.0 | 83.3 | 21.9 | 27 | 33.3 | 100.0 | 191 | 13.6 | |
| | Sexual pleasure (BRSEE) | Conservative | 59 | 66.7 | 27.2 | 46 | 0 | 100.0 | 187 | 10.4 | 0.774 |
| | | Radical | 50 | 50.0 | 35.0 | 70 | 0 | 100.0 | 222 | 28.0 | |
| | | Oncoplastic | 58.3 | 66.7 | 16.7 | 29 | 33.3 | 66.7 | 191 | 16.3 | |
| Symptoms | Symptoms of systemic therapy (BRST) | Conservative | 16.4 | 14.3 | 13.6 | 83 | 0 | 52.4 | 187 | 3.4 | 0.019 |
| | | Radical | 32.1 | 35.7 | 19.3 | 60 | 4.8 | 57.1 | 222 | 13.4 | |
| | | Oncoplastic | 20.5 | 19.0 | 17.2 | 84 | 0 | 57.1 | 191 | 10.7 | |
| | Breast symptoms (BRHL) | Conservative | 35.9 | 33.3 | 31.2 | 87 | 0 | 100.0 | 187 | 12.0 | 0.962 |
| | | Radical | 33.3 | 33.3 | 21.1 | 63 | 0 | 66.7 | 222 | 16.9 | |
| | | Oncoplastic | 38.1 | 33.3 | 35.6 | 94 | 0 | 100.0 | 191 | 26.4 | |
| | Symptoms in the arm (BRAS) | Conservative | 22.6 | 22.2 | 21.1 | 93 | 0 | 100.0 | 187 | 5.3 | 0.050 |
| | | Radical | 44.4 | 33.3 | 33.6 | 76 | 11.1 | 100.0 | 222 | 23.3 | |
| | | Oncoplastic | 25.6 | 22.2 | 27.2 | 107 | 0 | 77.8 | 191 | 16.9 | |
| | Anxiety due to hair loss (BRBS) | Conservative | 22.1 | 16.7 | 21.4 | 97 | 0 | 91.7 | 187 | 5.4 | 0.782 |
| | | Radical | 27.1 | 16.7 | 32.0 | 118 | 0 | 100.0 | 22 | 22.2 | |
| | | Oncoplastic | 20.0 | 16.7 | 13.1 | 66 | 0 | 41.7 | 191 | 8.1 | |

Univariate analysis of types of surgical treatment and their effects on quality of life scores in the EORTC QLQ-C30 and QLQ-BR23 questionnaires. *P* values obtained by one-way ANOVA. Higher scores on the functional scales indicate better quality of life, while higher scores on the symptom scales indicate greater symptom intensity.
CV: coefficient of variation; CI: confidence interval.

Body image showed the most significant interaction (p=0.008). Radical surgery was associated with progressive deterioration of body image in elderly patients. The difference between conservative and radical surgery was 22.9 points in the younger group (85.2 *versus* 62.3) and increased to 43.6 points in the ≥70 age group (76.3 *versus* 32.7). Complete separation of confidence intervals between the extreme groups was also observed (conservative surgery in young patients: 95%CI 75.0–95.4; radical surgery in elderly patients: 95%CI 14.3–51.1), reinforcing the robustness of the finding.

Overall, the data show that the negative impact of non-conservative approaches on quality of life is exacerbated by aging, especially after the age of 70. This age-modulating effect manifested itself differently across domains: while oncoplastic surgery was associated with greater impairment of overall quality of life and cognitive function in elderly patients, radical surgery had a more significant impact on body image in this age group.

The results presented in Figure 2 reinforce the need to consider age as a determining factor in the choice of surgical approach, suggesting that conservative techniques may be particularly beneficial in preserving the quality of life of elderly patients.

## DISCUSSION

This study evaluated the HRQoL of patients undergoing different surgical approaches in the treatment of BC and identified significant differences between the modalities, with emphasis on the negative impact associated with oncoplastic techniques, a result that contradicts part of the current literature.

The homogeneous age distribution between the ranges of 18 to 49 years (34.5%), 50 to 69 years (32.3%), and ≥70 years (33.2%) allowed for a balanced analysis of the impact of age on HRQoL. This distribution differs slightly from the national epidemiological pattern, which shows a higher prevalence of BC after the

**Table 4.** Multivariate analysis for type of surgical treatment and radiotherapy and chemotherapy for EORTC-QLQ-C30 and QLQ--BR23 scores.

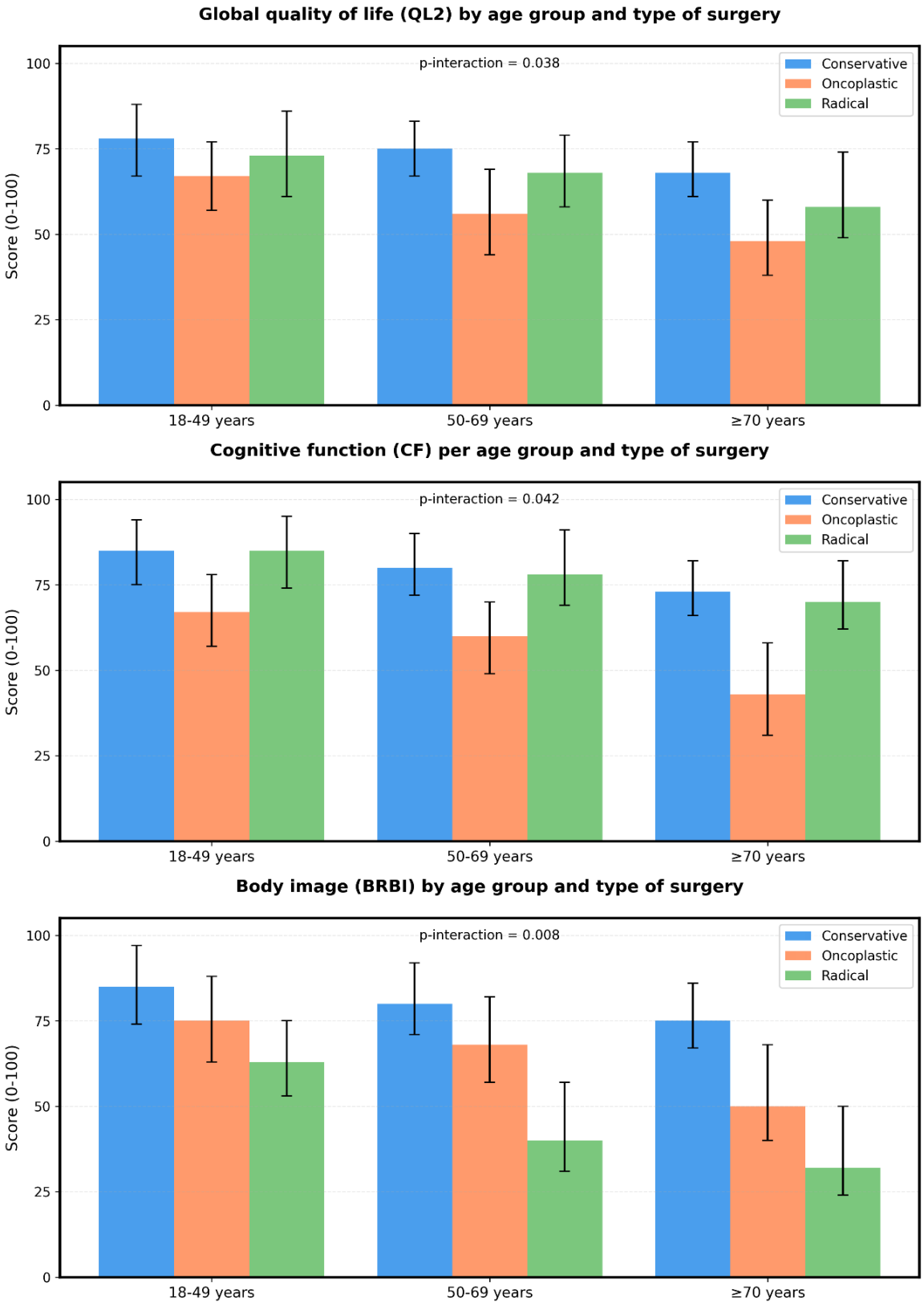
| | | | Coefficient β | 95%CI | p-value |
|---|---|---|---|---|---|
| QLQ-C30 | | | | | |
| Global | Overall quality of life (GL2) | Conservative | reference | - | - |
| | | Oncoplastic | -16.27 | -26.73 to -5.81 | 0.003 |
| | | Radical | -7.18 | -16.31 to -1.19 | 0.03 |
| | | Radiotherapy | -4.23 | -10.89 to 2.43 | 0.21 |
| | | Chemotherapy | -5.86 | -12.43 to 0.71 | 0.081 |
| Function | Cognitive (CF) | Conservative | reference | - | - |
| | | Oncoplastic | -22.34 | -34.61 to -10.07 | <0.001 |
| | | Radical | -2.85 | -14.87 to 9.17 | 0.640 |
| | | Radiotherapy | -4.48 | -12.54 to 3.58 | 0.274 |
| | | Chemotherapy | -8.96 | -16.91 to -1.01 | 0.027 |
| | Social (SF) | Conservative | reference | - | - |
| | | Oncoplastic | -19.15 | -29.53 to -8.77 | < 001 |
| | | Radical | -11.23 | -21.41 to -1.05 | 0.031 |
| | | Radiotherapy | -2.76 | -9.36 to 3.84 | 0.41 |
| | | Chemotherapy | -3.42 | -9.95 to 3.11 | 0.303 |
| QLQ-BR23 | | | | | |
| Function | Body image (BRBI) | Conservative | Reference | - | - |
| | | Oncoplastic | -14.52 | -28.76 to -0.28 | 0.046 |
| | | Radical | -34.27 | -48.15 to -20.39 | <0.001 |
| | | Radiotherapy | -5.64 | 14.92 to 3.64 | 0.232 |
| | | Chemotherapy | 8.73 | -17.87 to 0.41 | 0.061 |
| Symptoms | Side effects of therapy (BRST) | Conservative | reference | - | - |
| | | Oncoplastic | 15.23 | 7.31 to 23.15 | <0.001 |
| | | Radical | 4.26 | -3.51 to 12.03 | 0.281 |
| | | Radiotherapy | 4.11 | -1.12 to 9.34 | 0.124 |
| | | Chemotherapy | 12.45 | 7.28 to 17.6 | <0.001 |
| | Arm (BRAS) | Conservative | reference | - | - |
| | | Oncoplastic | 21.38 | 9.52 to 33.24 | <0.001 |
| | | Radical | 3.16 | -8.46 to 14.78 | 0.593 |
| | | Radiotherapy | 7.92 | 1.46 to 14.38 | 0.01 |
| | | Chemotherapy | 5.83 | 0.54 to 12.20 | 0.072 |

Multivariate analysis of treatment types (surgery, radiotherapy, and chemotherapy) and their effects on quality of life scores (EORTC QLQ-C30 and QLQ--BR23). Negative values indicate worse quality of life or function compared to conservative surgery (reference).
β: regression coefficient; 95% CI: 95% confidence interval.

age of 55[4]. This difference can be attributed to the profile of the study population, composed exclusively of state civil servants, a group with greater access to preventive examinations and early diagnosis.

The distribution of molecular subtypes in the sample, relatively homogeneous between luminal A (19.5%), luminal B (22.0%), luminal HER2 (20.8%), HER2+ (24.0%), and triple-negative (13.7%), differs from what is often described in the literature, in which luminal subtypes predominate[18]. This unique distribution may be related to the genetic-population characteristics of the sample and allows for a more detailed analysis of the impacts of each molecular profile on HRQoL.

The most relevant finding of the study was the association between oncoplastic surgery and worse HRQoL in several domains. Conservative surgery was associated with better overall HRQoL scores (mean=73.2) compared to oncoplastic (55.2) and radical (66.7) surgery (p=0.033), a result that corroborates previous data from Dauplat et al.[19], who reported better HRQoL scores in patients undergoing conservative surgery compared to mastectomy.




QL2: overall quality of life; CF: cognitive function; BRBI: body image; EP: standard error.

**Figure 2.** Interaction between age group and type of surgery on overall quality of life, cognitive function, and body image in breast cancer patients. Significant interaction between age group and type of surgery in the domains of overall quality of life, cognitive function, and body image (p-interaction=0.038, 0.042, and 0.008, respectively). Greater impairment of health-related quality of life associated with oncoplastic and radical techniques is observed in patients aged ≥70 years, with a progressive increase in the differences between conservative and non-conservative approaches in the older age groups. Values presented as mean and standard error.

However, the most unexpected result was the poorer performance of oncoplasty in domains such as overall QOL (β=-16.27; p=0.003), cognitive function (β=-22.34; p<0.001), and social function (β=-19.15; p<0.001), even after adjusting for adjuvant therapies. This result contrasts with the meta-analysis by Winters et al.[20], which suggests psychosocial benefits of breast reconstruction. However, more recent studies, such as the review by Santosa et al.[21], indicate that the psychosocial advantage of reconstruction may not be so consistent. In fact, the prospective study by Metcalfe et al.[22] showed that immediate breast reconstruction may be associated with lower satisfaction in some psychosocial domains in the long term.

Among the possible explanations for this finding is the profile of the patients who underwent oncoplasty in our sample. These women were predominantly younger, and young patients tend to experience a greater psychosocial impact after a diagnosis of breast cancer, especially in terms of body image and future prospects[23]. In addition, the high aesthetic expectations often associated with oncoplasty can lead to greater dissatisfaction when expectations are not fully met.

Although several studies in the literature, including systematic reviews and meta-analyses, report positive results with oncoplastic surgery, with high rates of aesthetic and psychosocial satisfaction[20,21], our findings demonstrated worse overall quality of life, cognitive function, and social function in the oncoplastic group, even after adjusting for adjuvant therapies. This divergence can be explained by multiple contextual factors.

First, it is important to note that all patients in the present study underwent exclusively therapeutic mammoplasty techniques (volume- -displacement), without the use of implants or myocutaneous flaps. Although these techniques are suitable for extensive resections with symmetrization[10,12], they involve greater tissue manipulation and prolonged surgery, which may contribute to symptoms in the arm and a greater burden of adverse effects in the postoperative period, as we observed in the domains of the QLQ-BR23.

Another aspect to be considered is the profile of the patients: women undergoing oncoplasty were, on average, younger, a group that tends to have greater aesthetic demands and greater psychosocial impact after a diagnosis of breast cancer[23]. Frustrated expectations regarding the aesthetic result can negatively affect the subjective perception of QOL, even in the case of technically adequate reconstructions.

In addition, possible selection bias should be considered. Oncoplastic techniques are often indicated in cases of larger tumors (≥T2) or less favorable locations, situations that already impose a greater physical and psychosocial impact on patients. In our multivariate analysis, we observed that tumor size ≥T2 was significantly associated with the indication for more extensive surgeries (oncoplastic or radical), reinforcing the influence of this factor. Although we do not have detailed data on tumor location, it is plausible that this characteristic also contributed to the lower QOL scores observed in the oncoplastic group.

Additionally, it is worth mentioning an important methodological limitation: we used the EORTC QLQ-C30 and QLQ-BR23 instruments, validated for general assessment of quality of life in oncology[15-17]. However, these instruments do not assess specific domains of satisfaction with the aesthetic result or with the reconstructed breast, as do the BREAST-Q modules[20,21]. The absence of this instrument may have limited the detection of subjective positive aspects of oncoplasty. In the future, we recommend the use of BREAST-Q in association with EORTC instruments for a more comprehensive and sensitive assessment of the impacts of surgery on the patient's experience.

Although EORTC QLQ-C30 and QLQ-BR23[15-17] are validated questionnaires widely used in BC studies, they do not capture in detail the aesthetic satisfaction and specific psychosocial aspects of breast reconstruction. The concomitant use of BREAST-Q[20,21] could have offered greater sensitivity in assessing the subjective outcomes of oncoplastic surgeries.

Another relevant factor was the higher frequency of arm symptoms (β=21.38; p<0.001) and side effects of systemic therapy (β=15.23; p<0.001) in patients undergoing oncoplastic surgery, which may be related to longer surgical time or the number of complementary procedures associated with the technique.

With regard to adjuvant therapies, chemotherapy showed a strong association with cognitive impairment (β=-8.96; p=0.027) and increased side effects (β=12.45; p<0.001), corroborating previous studies that identified persistent cognitive toxicities after the end of chemotherapy[24,25]. Janelsins et al.[25] demonstrated that up to 37% of patients maintain relevant cognitive deficits up to six years after the end of treatment.

The negative impact of radical surgery on body image was also clear (β=-34.27; p<0.001), reinforcing consistent findings in the literature[26]. However, the intermediate position of oncoplasty is surprising, since, despite its focus on aesthetic rehabilitation, it presented significantly lower scores than conservative surgery (β=-14.52; p=0.046) in the domain of body image.

Multivariate analysis allowed for a more robust assessment of the factors related to the choice of surgical approach, controlling for potential selection biases between groups. Among the variables analyzed, only age ≥70 years and tumor size ≥T2 were independent predictors of more extensive surgery (oncoplastic or radical).

This finding is consistent with clinical practice and the existing literature, which indicate a greater propensity for mastectomy or oncoplasty in elderly patients with larger tumors, either due to technical limitations for breast conservation or due to medical or patient preference. On the other hand, other variables, such as comorbidities, molecular subtype, or lymph node status, did not show significant influence after multivariate adjustment.

These data reinforce the clinical comparability of the groups evaluated in relation to most baseline characteristics and suggest that the findings on QOL observed in the present study are little influenced by biases related to the distribution of prognostic or therapeutic factors.

Finally, contrary to expectations, radiotherapy did not have a significant impact on overall HRQoL. This can be explained by advances in radiotherapy techniques, such as hypofractionation and conformal radiotherapy, which reduce late toxicities, as well as the acceptance of this modality as part of the therapeutic protocol in conservative surgeries[24-27].

Despite its contributions, the study has limitations, such as its cross-sectional design, which prevents the evaluation of the temporal evolution of HRQoL, and the absence of data on postoperative complications that could influence the outcomes. In addition, the socioeconomic and educational profile of the sample limits the generalization to populations from other regions or with less access to health services. Thus, we recommend that HRQoL assessment be systematically integrated into clinical practice, contributing to more patient-centered decisions and more effective physical and psychosocial rehabilitation strategies.

## CONCLUSIONS

The present study showed that HRQoL in patients with BC is significantly influenced by the type of surgical approach, even after adjusting for other therapeutic factors. Contrary to theoretical expectations, oncoplastic techniques were associated with impairments in several domains of HRQoL, while conservative procedures demonstrated more favorable results in psychosocial and functional aspects. These findings suggest the need for an individualized approach in the selection of the surgical modality, considering not only aesthetic or oncological outcomes, but also the potential impacts on overall QOL. It is recommended that therapeutic planning incorporate systematic HRQoL assessments, providing a basis for interventions aimed at physical and psychosocial rehabilitation, according to the specific needs identified for each surgical modality.

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## CONTRIBUTION OF THE AUTHORS

MA: Project management, Conceptualization, Methodology, Supervision, Validation. MSB: Formal analysis, Data curation, Writing – first draft, Research, Validation, Visualization. AGDP: Formal analysis, Data curation, Writing – first draft, Research, Validation, Visualization. AM: Conceptualization, Writing – revision and editing, Methodology, Supervision. FPC: Writing – revision and editing, Research, Validation. FZ: Writing – revision and editing, Methodology, Validation. ECM: Writing – revision and editing, Methodology, Supervision. FPB: Writing – revision and editing, Methodology, Validation. ALF: Conceptualization, Writing – revision and editing, Methodology, Supervision. OF: Writing – revision and editing, Research, Resources.

### Supplementary file

https://docs.google.com/document/d/1qSyYZtiTRWEqOHL6z5_XhTYj2uYNTt3B/edit?usp=sharing&ouid=102025661766701306051&rtpof=true&sd=true (The role of the editor in the publication process).

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