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ORIGINAL PAPER

Surgical choices and complications in elderly women: a single center retrospective analysis in frail vs. non frail breast cancer patients

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Abstract

Background Early breast cancer (EBC) in the elderly is a major public health problem and a risk factor for undertreatment. The authors aim to describe surgical patterns and outcomes of an elderly population diagnosed with EBC treated in a BC-dedicated reference center.

Methods Retrospective study for all EBC patients ≥70 years old submitted to breast surgery from 2018 to 2021. Patients were included if submitted to the G8 screening tool. Data on standard demographics, surgery performed, and outcomes were collected.

Results Overall, 192 patients were included. Frail patients were significantly older ($p<0.01$), had worse Charlson Comorbidity Index ($p<0.01$) and ASA ($p<0.01$) scores and more comorbidities ($p=0.09$). In total, 199 breasts were operated; 173 breast conservative surgeries (BCS) and 26 mastectomies. In the frail population, oncoplastic surgery after BCS was more frequently mammoplasty; no reconstruction was reported after mastectomy. In the fit group, more diversity was seen in oncoplastic procedures; 13 breasts underwent direct-to-implant breast reconstruction (BR) after mastectomy. Frail patients were less likely to be offered BR ($p<0.01$). There was no association between frailty and postoperative complications, in-hospital length of stay, readmission, or reintervention.

Conclusions Our results suggest that G8 frail patients are less likely to be offered BR. Even if there were no significant differences in surgical adverse outcomes between groups, this could have been masked by a higher proportion of BR among fit patients. G8 screening can be a useful instrument to support the surgeon's decision to whether or not to consider BR in elderly breast cancer patients.

Level of Evidence: Level IV, Risk/Prognostic Study.

Keywords Elderly · Breast cancer · Frailty assessment · Breast reconstruction

Introduction

Breast cancer is the most common cancer among women and the second leading cause of cancer death in this population, after lung cancer [1]. With longer life expectancy, we are facing demographic changes with a rising proportion of older people worldwide, the so called silver tsunami. The risk of breast cancer diagnosis increases with age and peaks among women aged 70–79 years [1]. At present, one-third of all breast cancers occur in women aged 70 years or more [2]. As the population ages, the proportion of elderly women diagnosed with breast cancer will increase in parallel and it is estimated that the global number of new cases among

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women aged ≥ 70 years will more than double over the next three decades [3].

Although the elderly represent a significant proportion of breast cancer patients, this population is under-represented in clinical trials and there is a lack of evidence on the optimal management of these patients [4, 5]. Currently, there are limited studies examining the outcomes of women older than 70 years undergoing breast surgery and there are few standardized guidelines addressing recommended treatments for this age group [2, 6]. The lack of evidence in the literature with regard to reconstruction and oncoplastic breast-conserving surgery (BCS) in the elderly reflects the underuse of these techniques in this age group [2, 7, 8].

Undertreatment is a recognized problem among the elderly patients diagnosed with breast cancer. Older adults with cancer often have multiple chronic illnesses and geriatric syndromes which make them more prone to side effects and treatment-related mortality [9, 10]. Also, older women usually have more indolent tumors with favorable biological profiles and are more likely to succumb from other conditions rather than the cancer itself [10, 11]. If, on one side, this may explain why treatment options are frequently withhold in these patients, on the opposite side, undertreatment can contribute to their poor outcomes and low survival rates [5].

There is a significant variation in the surgical treatment provided to old women with breast cancer between medical centers [12, 13]. Nevertheless, there is a consensus across different studies regarding the lower probability for older women with breast cancer to be offered or receive breast reconstruction (BR) and we can see that this relative difference increases with age [14–16]. Of the small proportion of elderly women for which BR is contemplated and who do receive it, they are mostly offered less complex implant-based reconstruction [16–19]. This observation may be attributed to reluctance of clinicians who are concerned about elderly women not being able to tolerate the longer operating times of a more invasive and technical demanding autologous reconstruction [16, 20].

Several issues can potentially influence this discrepancy in reconstruction rates between young and old populations. Elderly women are prone to renounce any kind of breast reconstruction presumably due to societal and cultural issues, with many women believing that reconstruction is not a priority in their health care and personal well-being, and because of age related changes in perception of body image [2, 15, 19]. On the other side, there may still be a common stance among surgeons on the reluctance to offer reconstruction, because of concerns about the risks of additional surgery with potential complications, further hospitalizations and uncertain outcomes [19]. Ultimately, this major disparity may be attributed to a lack of patient education and information as well as surgeon bias regarding the safety or relevance of BR in older women, owing to an absence of consensus and standardization of care, and a paucity of evidence on postoperative outcomes [21].

In general, the benefits of BR are well-documented and accepted. They include improved body-image, psychological well-being, self-esteem and quality-of-life [22]. Older women still derive biopsychological benefit from reconstruction as the breast may remain a significant part in a women's identity, confidence and sexuality despite the aging [13]. On the other hand, as an elective surgery, benefits and risks should be carefully evaluated before exposing the patient to a procedure which increases the chances of complications. As such, the surgeon should take into consideration the woman's wish for reconstruction and be able to stratify the risk for postoperative adverse outcomes in elderly patients submitted to breast surgery.

The geriatric population is remarkably heterogeneous in regard to its health status, with considerable differences in terms of co-morbidities, physiological reserves, functional capacity, social situation, cognitive function, cultural beliefs, and desire for treatment [9, 14]. As a result of these differences, benefit from treatment can differ, and evaluating the candidacy for elective surgery in this population is certainly a challenging task [9]. Aging is a physiologic process in which there is deterioration in terms of cellular homeostasis and functional reserve, compromising the ability to cope with stressors such as surgery. This physiologic decline varies among individuals and is considered to be more accurate for assessing the risk of surgery than age itself [5, 23, 24]. Evidence suggest that chronological age alone is not a reliable predictor of postoperative complications and should not be used to exclude older adults from being considered for standard surgical procedures [9, 25]. Instead, geriatric assessment, a life expectancy estimation, and competing causes of mortality should be a mandatory part in these patient's management and treatment.

Tests such as comprehensive geriatric assessment (CGA) have been introduced to evaluate the real physiological and functional condition of old patients. Although CGA has the advantage of being the most complete evaluation tool available to identify the overall health status of the elderly patient, it is complex and time-consuming and does not appear to be a suitable instrument in clinical practice [25, 26]. With an increasing number of older patients diagnosed with cancer, screening methods have been developed to identify those at risk for adverse health outcomes. The screening questionnaire Geriatric 8 (G8) proved to have the highest sensitivity compared to the TRST 1+, GFI, and VES 13 screening tools [27]. Moreover, G8 assessment tool has been reported to be an important outcome predictor in surgical oncogeriatric patients, with frail patients showing a significantly prolonged hospital stay, higher rate of delirium, and higher 1-year mortality rate [28]. Final scores range from 0 to 17, with score below 14 indicating a geriatric risk profile.

The aim of this study is to describe and analyze the differences in surgical patterns between frail and non-frail patients and to assess the predictive value for postoperative adverse outcomes using the G8 screening tool in an elderly population diagnosed with EBC treated in a European EUSOMA (European Society of Breast Cancer Specialists) accredited Breast Unit (BU).

Patients and methods

Study design

This is a monocentric retrospective study, including elderly patients operated for a breast cancer between January 2018 and December 2021. All patients' data were retrieved from the institution's electronic medical records and transferred as structured data for further statistical analyses.

The study was conducted according to the criteria of Good Clinical Practice and following the principles outlined in the Declaration of Helsinki of 1964, updated in Fortaleza 2013.

Study sample

All female patients aged 70 years or older who had surgical treatment with curative intent for breast cancer were included. Patients were considered eligible if they were newly diagnosed with breast cancer, and underwent G8 screening at the time of diagnosis. Patients with metastatic disease (stage IV) or a synchronous malignant tumor, from other organ, were excluded from the analysis. Prior to surgery, all patients underwent standard preoperative exams, physical examination, locoregional and systemic staging according to internal protocols.

Data collection

Patient, tumor, and treatment characteristics were collected for all selected patients. Patient's related variables included age at time of diagnosis, comorbidities, body mass index (BMI), Charlson Comorbidity Index (CCI), American Society of Anesthesiologists Classification (ASA) score, and smoking history. For tumor characteristics, this included tumor type (WHO classification), tumor stage (AJCC 8th edition classification), grading, hormone receptor status (estrogen and progesterone), human epidermal growth factor receptor 2 (HER2) status, and Ki67. Treatment variables collected included medical therapy [(neo)adjuvant radiotherapy, chemotherapy, or hormonal therapy] and type of surgical resection and reconstruction. Median follow-up time was 30 months.

Frailty assessment

Frailty assessment was conducted using the G8 screening tool. This was completed by the BU's oncology nurses for all included patients as a part of routine work-up. Patients with a G8 score below or equal to 14 were considered frail and >14 as fit. When a G8 score bellow 14 was detected a complete geriatric assessment was included. The score was incorporated in the Electronic Patient Registry and included as a routine at the multidisciplinary tumor board meeting for treatment decision.

Endpoints

The primary outcomes of interest were to assess the type of breast and axillary surgery and reconstruction offered to either frail and fit patients, as well as the role of G8 score in predicting surgical and medical postoperative complications and 6-month mortality. Surgical complications were further divided into breast and axillary complications. Postoperative complications were graded using the Clavien-Dindo criteria, which assesses their severity from 1 to 5. Grade 0 means no complication, Grade 1–2 minor, 3–4 major morbidity, and Grade 5 is related to postoperative death. Secondary outcomes were readmission and re-intervention rates and length of hospital stay.

Surgical procedures performed were BCS or mastectomy with or without reconstruction (oncoplastic techniques, implant-based, autologous, balancing procedures) and axillary surgery (sentinel lymph node biopsy, axillary dissection). Mastectomy was performed for patients with inflammatory breast cancer or unfavorable tumor/breast dimension ratio in case of patients' preference. Sentinel lymph node biopsy was offered to patients with clinically negative axilla. Axillary surgery was omitted in patients with cT1N0 luminal A-like tumors or with short life expectancy, as recommended by the EUSOMA and the International Society of Geriatric Oncology. Axillary lymph node dissection was carried out in the presence of clinically and/or imagiologically positive axilla or in case of 2 or more histologically verified sentinel node metastasis. Targeted axillary dissection was performed with removal of lymph nodes marked with a clipped biopsy previously to neoadjuvant systemic therapy (cN1-ycN0).

Statistical analysis

Numerical variables were described by their mean and standard deviation or median and interquartile range (IQR), depending on their adherence to the normal distribution. Categorical variables were described by their count and percentages. Differences in the distribution of numerical variables between the "frail" and the "fit" groups were compared

using the Mann–Withney test, while categorigal variables were compared using the qui-square and the Fisher's exact tests.

Results

Between 2018 and 2021, 264 patients aged ≥ 70 years with breast cancer who underwent oncological breast surgery were identified. Six patients were excluded due to metastatic disease (*n*=4) or a synchronous tumor (*n*=2). A total of 192 patients completed the G8 frailty screening tool and were considered eligible for the analysis.

The median age of screened patients at time of surgery was 77 years (IQR 73.0–80.0) and median BMI was 26.4, 18,2% of these patients considered obese. Comorbidities were prevalent in the studied population, in particular hypertension (*n*=119; 62%) and hypothyroidism (*n*=39; 20,3%), with 96% of patients having at least one comorbidity; 78% were classified as ASA II or III and 78% had a CCI of 3 or 4 (ranging 3 to 7).

Most patients presented with newly diagnosed breast cancer at first presentation, 168 (87,5%) unilateral and 7 (3,6%) bilateral; 9 (4,7%) had a past history of contralateral breast cancer and 8 (4,2%) presented with ipsilateral local recurrence. HR-positive tumors were found in 84% of patients, of which 40.6% had neoadjuvant and 93,1% adjuvant hormonal therapy.

Overall, 199 breasts were operated, with 7 patients having bilateral tumors. One hundred and seventy three (86,9%) of these were BCS and 26 (13,1%) were mastectomies. Oncoplastic procedures with breast displacement techniques in the form of mammoplasty or breast replacement techniques with perforator flaps were performed in 42 (24,3%) and 4 patients (2,3%), respectively, after BCS. One patient had ipsilateral augmentation mammoplasty with implant and 36 (20,8%) underwent contralateral breast symmetrization. Following mastectomy, half (*n*=13) of patients received BR with implants and the other half no reconstruction at all, with seven (41,2%) of these patients having contralateral breast symmetrization. Axillary surgery was omitted in 12 (6,0%) cases. When performed, it was mainly for tumor staging with 141 sentinel node biopsies (70,9%), but also for therapeutic axillary lymph node dissection in 46 cases (23,1%).

In total, complications were registered in 47 (23,6%) of the breasts operated. This included surgical complications, namely seroma (*n*=18; 9,0%), hematoma (*n*=12; 6,0%), wound dehiscence (*n*=4; 2,0%), breast infection (*n*=3; 1,5%), skin necrosis (*n*=2; 1,0%), granuloma (*n*=1; 0,5%), or capsular contracture (*n*=1; 0,5%); and medical complications, comprising atrial fibrillation with rapid ventricular response or tachycardia-bradycardia syndrome (*n*=3; 1,5%), herpes zoster infection (*n*=1; 0,5%), anaphylaxis (*n*=1; 0,5%) and death at 2 months after surgery (*n*=1; 0,5%). After BR, the rate of postoperative complications was considerably higher (66,7%), with 12 observed complications in 18 reconstructed breasts. Axillary complications occurred in 13 (7,0%) cases of 187 axillary surgeries, and this included seroma (*n*=7; 3,7%), hematoma (*n*=1; 0,5%), infection (*n*=1; 0,5%), and upper limb lymphedema (*n*=4; 2,1%).

Overall, the surgical reintervention rate for secondary surgery was 5% and the median hospital length of stay was 2 days (range 1–8 days).

Frailty assessment

Based on the G8 frailty screening tool, 67 patients were categorized as "frail" (34,9%) and 125 (65,1%) not-frail. The median G8 score for frail patients was 12,8 (range 7–14) and for fit patients 15,7 (range 14,5–17). Frail patients were significantly older ($p<0.01$), had worse CCI ($p<0.01$) and ASA ($p<0.01$) scores. Comorbidities were numerically more frequent among frail patients, though statistical significance was not achieved ($p=0.09$), except for Diabetes *mellitus* ($p<0,01$). There were also more underweight patients in this group ($p=0,04$).

Both groups were similar regarding tumor characteristics and the type of oncological breast surgery performed, with an equal proportion of breast conservation versus mastectomy, 86,9% and 13,1% respectively.

In the frail population, 21 breasts (35%) underwent oncoplastic procedures after breast conservation, 20 therapeutic mammoplasties, and 1 lateral intercostal artery perforator (LICAP) flap, while in the fit group more diversity was seen with 25 breasts (23%) being submitted to plastic surgical reshaping techniques by mammoplasty (*n*=22), LICAP flap (*n*=3), or implant-based reconstruction (*n*=1). No reconstruction was reported after mastectomy in frail patients. On the other hand, 76,5% (*n*=13) of the breasts in fit patients were reconstructed with immediate breast implant after mastectomy. Accordingly, frail patients were less likely to be offered BR ($p<0.01$). Axillary surgery had a similar pattern in both groups.

Outcomes

Despite the higher rate of complications after breast surgery among the frail population (29,0% vs 20,8%), this difference was not statistically significant ($p=0,19$), neither was the grading of complications by Clavien–Dindo classification.

Only one death was registered in this study, which occurred in a frail (G8 score: 11.0) patient at 2 months postoperatively (Fig. 1).

There were 8 reinterventions (6,4%) to manage immediate complications in the non-frail group, half of them in reconstructed breasts, while only one (1,5%) was necessary in the frail group. Two (3,0%) in-hospital readmissions occurred among the G8-frail patients for treatment of complications, while in the fit population 7 (5,6%) readmissions were recorded, 5 of them in reconstructed breasts. Median in-hospital length of stay was equal between groups, ranging 2–8 days in frail patients and 1–5 days in fit patients.

The baseline patient, tumor and treatment characteristics, and clinicopathological features for the cohort of 192 patients enrolled in this study are depicted in Table 1.

Discussion

With the rising prevalence of breast cancer among the elderly population, surgeons are expected to encounter an increasing number of older women eligible for breast oncoplastic and reconstructive procedures.

While the benefits of breast reconstruction in younger women are well established, older women diagnosed with breast cancer are underrepresented in clinical trials and few of them undergo BR [5, 29].

Older adults generally have a greater risk of mortality and complications after surgical procedures [18, 30, 31]. Nonetheless, numerous studies have shown that this increased morbidity and mortality risk is not related to chronological age itself, but to the higher prevalence of comorbidities, vulnerability and functional decline that correlate with age [5, 23, 32–34].

Numerous studies investigating the relationship between preoperative frailty and postoperative outcomes have shown an association between frailty and the rate of postoperative complications, mortality, in-hospital length-of-stay or discharge disposition [35]. This correlation seems to be present across a variety of surgical specialties [9, 33]. G8 screening tool has been applied to surgical oncology in an attempt to unveil the effects of frailty on postoperative course. It is a cost-effective instrument as it has proved to be convenient, easy, and quick to administer. A recent prospective trial by Bruijnen et al. [28] evaluated the G8 application in the surgical setting as a screening tool in older cancer patients diagnosed with solid neoplasia. It demonstrated that G8 is a useful screening tool,

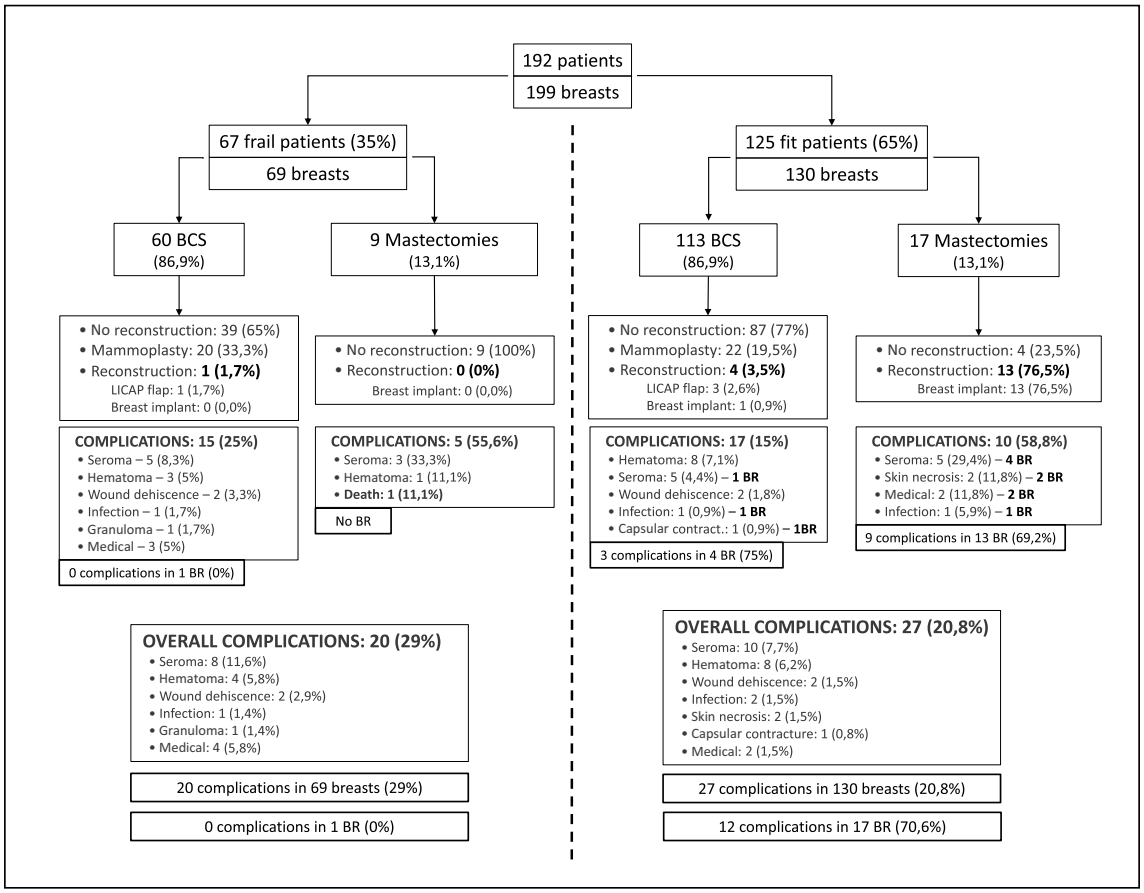

Fig. 1 Surgical patterns and complications in G8-frail versus non-frail patients. BCS, breast conservative surgery. BR, breast reconstruction

Table 1 Statistical analysis with baseline characteristics, surgical patterns and complications in G8-frail and G8-fit patients

Variable	G8 ≤ 14	G8 > 14	*p*-value
Age (years)	67 patients	125 patients	<0.01
Median	79.0	75.0	
Interquartile range	75.0–85.0	72.0–77.0	
Minimum and maximum	70.0–90.0	70.0–91.0	
Presentation	67 patients (100%)	125 patients (100%)	0.56
Unilateral BC at presentation	61 (91.0%)	107 (85.6%)	
Contralateral BC recurrence	3 (4.5%)	6 (4.8%)	
Ipsilateral BC recurrence	1 (1.5%)	7 (5.6%)	
Bilateral BC at first presentation	2 (3.0%)	5 (4.0%)	
Histology	69 breasts (100%)	130 breasts (100%)	0.49
NOS	50 (72.5%)	84 (64.6%)	
Lobular	9 (13.0%)	20 (15.4%)	
Other	10 (14.5%)	26 (20.0%)	
Tumor grade	69 breasts (100%)	130 breasts (100%)	0.10
G1	5 (7.2%)	22 (16.9%)	
G2	44 (63.8%)	65 (50.0%)	
G3	18 (26.1%)	29 (22.3%)	
Unknown	2 (2,9%)	14 (10,8%)	
Hormonal receptor	69 breasts (100%)	130 breasts (100%)	0.21
Negative	14 (20.3%)	19 (14.6%)	
Positive	53 (76.8%)	107 (85.6%)	
Unknown	2 (2,9%)	4 (1,6%)	
HER-2	69 breasts (100%)	130 breasts (100%)	0.08
Negative	60 (87.0%)	105 (80.8%)	
Equivocal	3 (4.3%)	20 (15.4%)	
Positive	6 (8.7%)	5 (3.8%)	
Ki67	69 breasts (100%)	114 breasts (100%)	0.10
<20	11 (15.9%)	34 (29.8%)	
≥20	58 (84.1%)	96 (84.2%)	
Body mass index	67 patients (100%)	125 patients (100%)	0.04
Underweight	3 (4.5%)	0 (0.0%)	
Normal weight	29 (43.3%)	48 (38.4%)	
Overweight	21 (31.3%)	56 (44.8%)	
Obesity	14 (20.9%)	21 (16.8%)	
Comorbidities	67 patients (100%)	125 patients (100%)	0.55
No	3 (4.5%)	9 (7.2%)	
Yes	64 (95.5%)	116 (92.8%)	
If comorbidities: "yes"	64 patients (100%)	116 patients (100%)	0.09
One	16 (25%)	37 (31.9%)	
Two	14 (21.9%)	37 (31.9%)	
Three or more	34 (53.1%)	42 (36.2%)	
Comorbidity: hypertension	67 patients (100%)	124 patients (100%)	0.76
No	24 (35.8%)	48 (38.7%)	
Yes	43 (64.2%)	76 (61.3%)	
Comorbidity: diabetes mellitus	67 patients (100%)	125 patients (100%)	<0.01
No	51 (76.1%)	116 (92.8%)	
Yes	16 (23.9%)	9 (7.2%)	
Comorbidity: hypothyroidism	67 patients (100%)	125 patients (100%)	0.85
No	54 (80.6%)	99 (79.2%)	
Yes	13 (19.4%)	26 (20.8%)	
Comorbidity: COPD	67 patients (100%)	125 patients (100%)	0.55

Table 1 (continued)

Variable	G8 ≤ 14	G8 > 14	*p*-value
No	64 (95.5%)	116 (92.8%)	
Yes	3 (4.5%)	9 (7.2%)	
Smoking	67 patients (100%)	125 patients (100%)	0.39
Non-smoker	55 (82.1%)	93 (74.4%)	
Smoker	3 (4.5%)	5 (4.0%)	
Ex-smoker	9 (13.4%)	27 (21.6%)	
Charlson comorbidity index	67 patients (100%)	125 patients (100%)	<0.01
3	16 (23.9%)	70 (56.0%)	
4	25 (37.3%)	39 (31.2%)	
5	11 (16.4%)	12 (9.6%)	
6	12 (17.9%)	3 (2.4%)	
7	3 (4.5%)	1 (0.8%)	
ASA	67 patients (100%)	125 patients (100%)	<0.01
1	1 (1.5%)	3 (2.4%)	
2	39 (58.2%)	103 (82.4%)	
3	25 (37.3%)	17 (13.6%)	
4	2 (3.0%)	2 (1.6%)	
5	0 (0.0%)	0 (0.0%)	
6	0 (0.0%)	0 (0.0%)	
Tumor Size	69 breasts (100%)	130 breasts (100%)	0.25
Tis	0 (0.0%)	10 (7.7%)	
T1	34 (49.3%)	60 (46.1%)	
T2	29 (42.0%)	52 (40.0%)	
T3	5 (7.2%)	7 (5.4%)	
T4	1 (1.5%)	1 (0.8%)	
Lymph node	69 breasts (100%)	130 breasts (100%)	0.93
N0	52 (75.4%)	102 (78.5%)	
N1	12 (17.4%)	19 (14.6%)	
N2	4 (5.8%)	7 (5.4%)	
N3	1 (1.4%)	2 (1.5%)	
Axillary surgery	69 breasts (100%)	130 breasts (100%)	0.42
No axillary surgery	3 (4.3%)	9 (6.9%)	
Sentinel node biopsy	48 (69.6%)	93 (71.5%)	
Axillary lymph node dissection	18 (26.1%)	28 (21.5%)	
Breast surgery	69 breasts (100%)	130 breasts (100%)	1.00
Breast-conserving surgery	60 (87.0%)	113 (86.9%)	
Mastectomy	9 (13.4%)	17 (13.1%)	
Immediate breast reconstruction	69 breasts (100%)	130 breasts (100%)	0.01
No	68 (98.6%)	113 (86.9%)	
Yes	1 (1.5%)	17 (13.1%)	
Type of reconstruction	1 breast (100%)	17 breasts (100%)	0.24
Prosthesis	0 (0.0%)	14 (81.3%)	
LICAP	1 (100%)	3 (18.8%)	
Mammoplasty	69 breasts (100%)	130 breasts (100%)	0.04
No	49 (71.0%)	108 (83.1%)	
Yes	20 (29.0%)	22 (16.9%)	
Radiotherapy	67 patients (100%)	125 patients (100%)	1.00
No	8 (11.9%)	14 (11.2%)	
Yes	59 (88.1%)	111 (88.8%)	
Neoadjuvant chemotherapy	67 patients (100%)	125 patients (100%)	0.03
No	58 (86.6%)	91 (72.8%)	

Table 1 (continued)

Variable	G8 ≤ 14	G8 > 14	*p*-value
Yes	9 (13.4%)	34 (27.2%)	
Adjuvant chemotherapy	67 patients (100%)	125 patients (100%)	0.61
No	62 (92.5%)	112 (89.6%)	
Yes	5 (7.5%)	13 (10.4%)	
Neoadjuvant endocrine therapy	53 patients (100%)*	107 patients (100%)*	0.31
No	28 (52.8%)	67 (62.6%)	
Yes	25 (47.2%)	40 (37.4%)	
Adjuvant endocrine therapy	53 patients (100%)*	106 patients (100%)*	0.75
No	3 (5.7%)	8 (7.5%)	
Yes	50 (94.3%)	98 (92.5%)	
Breast surgery complication (23,6%)	69 breasts (100%)	130 breasts (100%)	0.19
No	49 (71.0%)	103 (79.2%)	
Yes	20 (29.0%)	27 (20.8%)	
Which (*n*=47)	20 breasts (100%)	27 breasts (100%)	0.83
Infection	1 (5.0%)	2 (7.4%)	
Hematoma	4 (20.0%)	8 (29.6%)	
Seroma	8 (40.0%)	10 (37.0%)	
Wound dehiscence	2 (10.0%)	2 (7.4%)	
Skin necrosis	0 (0,0%)	2 (7,4%)	
Capsular contracture	0 (0,0%)	1 (3.7%)	
Granuloma	1 (5.0%)	0 (0,0%)	
Medical	4 (20,0%)	2 (7,4%)	
Axillary complication (7,0%)	66 breasts (100%)	121 breasts (100%)	0,36
No	66 (95.5%)	111 (91.7%)	
Yes	3 (4.5%)	10 (8.3%)	
Surgical reintervention	67 patients (100%)	125 patients (100%)	0.17
No	66 (98.5%)	117 (93.6%)	
Yes	1 (1.5%)	8 (6.4%)	
In hospital readmission	67 patients (100%)	125 patients (100%)	1.00
No	65 (97.0%)	118 (94.4%)	
Yes	2 (3.0%)	7 (5.6%)	
Clavien-Dindo surgical complications	23 breasts (100%)	37 breasts (100%)	0.32
Minor complications	18 (78.3%)	26 (70.3%)	
Major complications	4 (17.4%)	11 (29.7%)	
Death	1 (4.3%)	0 (0.0%)	
In hospital length of stay (days)	67 patients	125 patients	0.14
Median	2.0	2.0	
Innterquartile range	2.0–3.0	2.0–3.0	
Minimum and maximum	2.0–8.0	1.0–5.0	

*HR-negative patients excluded

as patients with an impaired G8 are more at risk of adverse postoperative outcomes. Other studies assessing the G8 screening tool in elderly patients diagnosed with cancer from different organs have demonstrated its suitability for the prediction of postoperative complications, longer median postoperative hospital stay or a higher morbidity [26, 36, 37].

Although the G8 frailty screening tool is commonly used in oncology for identifying frailty and patients at risk of postoperative complications, very few studies have assessed this tool in older breast cancer patients and, to our best knowledge, none in breast reconstructive surgery.

Several studies evaluated breast surgery and different types of reconstruction in older women, focusing on surgical and patient-reported outcomes. Nonetheless, the heterogeneity of these studies in terms of sample size, older age definition, patient cohorts, and data presented raise numerous confounding variables that may hamper appropriate conclusions.

Some of these studies recognize that the incidence of breast-site and medical complications among elderly women undergoing BR is likely greater than that among women of all ages. Lipa et al. reported significantly higher rates of complications for implant-based reconstruction in patients aged over 65 years compared to patients of all ages (77% vs. 37%). However, complication rates for autologous procedures were similar between the two groups (35.3% vs. 33.9%) [38]. Chang et al., in his study of microvascular reconstruction procedures, reported a complication rate of 29% in women younger than 50, as opposed to a rate of 42,6% in those aged 70 and older [39]. Laporta et al. [19] conducted a retrospective review of 1251 breast reconstructions in 993 patients, which were divided in 4 groups according to age, with group A having patients younger than 50 years and group D having patients older than age 70 years. If we consider patients at the extremes of age (group A and D), we observe rates of surgical complications (22,1% vs. 32,1%), implant loss (5,4% vs. 21,4%), and take-backs to the theater (35,2 vs. 47,6%) in group A and group D, respectively. On the other hand, the length of hospital stay, a surrogate for medical complication, was longer (6,2 vs. 4,9 days) among patients in group A.

This contrasts with the findings of some studies which have pointed that women do not have higher complication rates, more reoperations and revisions or longer hospital stays after BR based on age alone [16, 19, 30, 40–42]. However, even if these studies do not report statistically significant differences between older and younger patients, we can observe that the rates for older patients are higher in most of the outcome variables. Dejean et al. [42] carried out a retrospective study of 79 patients 65 years and older submitted to BR with DIEP flap and demonstrated a postoperative complication rate and mean inpatient stay duration similar to that reported in the literature for all ages. They hypothesized that these results were due to selection of the candidates with limited comorbidities, lower ASA scores, and better physiological capacity.

These contradictive results may be explained by the fact that the majority of current studies investigating BR in older women comprise small, heterogeneous, retrospective case series that carry selection bias, due to the selection of only healthier older patients by clinicians. Also, the cut-off for defining old age varies between studies, and most patients in the analysis are younger than 70 years old. Women in the older age brackets are frequently excluded in major studies and, if included, they are only represented by small numbers that are statistically weak [32]. It may also be argued that using two age groups, as most of these studies have done, is insufficient to effectively evaluate the impact of advancing age on BR outcomes, especially when using an arbitrary cut-off for defining "old age." Instead, evaluating age as a continuous rather than categorical variable should be more appropriate [16].

In turn, there is a consensus among studies on the significant benefits BR yields in the quality of life of older women, by improving esthetics, satisfaction, and psychosocial health, regardless of the survey methods and questionnaires used [17, 21, 30, 42–44].

Even if different studies demonstrate that BR is safe and has favorable effects in the life of elderly women, it also significantly increases the risk of complications [31, 32]. Besides the high rate of complications in reconstructed breasts, there is also a considerable part of reconstructive failures. Lipa et al. reported a 42% rate of early or late complications in implant-based reconstructions requiring removal of the breast implant. Two-third of those patients abandoned further attempts at reconstruction, leaving them without a breast after several operations [38]. If, on one side, it has become accepted that BR improves self-esteem, sexuality, and body image, it is also true that this is an elective procedure which considerably increases the risk for complications. As such, it is important to consider that, in some cases, the risks of reconstruction can outgrow the benefits of the procedure, in a group of patients which already face a higher vulnerability for stressor events. In elderly patients, the level of frailty, comorbidities, life-expectancy estimation, and patient preferences must be carefully weighed against the risks of BR. The National Comprehensive Cancer Network (NCCN) and American Society of Clinical Oncology (ASCO) guidelines recommend evaluating life expectancy for treatment decision-making. Since competing mortality risks are more prevalent in older adults, even without multimorbidities, clinicians should consider the risk of dying of other causes when proposing women for BR [5]. A mortality index, such as the Suemoto index used in our BU, can be employed to predict ten-year all-cause mortality using age, sex, comorbidities, and functional and cognitive measures [45].

This study assessed the surgical patterns of an elderly population diagnosed with breast cancer treated in a reference center which routinely applies the G8 screening tool to women aged 70 years and older. It also sought to assess if the patients' stratification as fit or frail can identify those at risk of adverse outcomes after breast surgery.

In our study, frailty status did not interfere with the clinical decision whether to perform BCS or mastectomy as we can observe an equal proportion of the procedures in both groups. Similarly, G8 score did not seem to be relevant for the decision-making on the surgical axillary management.

In the frail population, one third of patients underwent oncoplastic surgery by therapeutic mammoplasty after BCS, while only one had a LICAP flap for breast tissue replacement, making the former procedure the preferred technique in this patient group. On the other hand, more diversity was seen in the fit patients' bracket submitted to BCS, with 20%

mammoplasties, 3 LICAP flaps, and 1 augmentation mammoplasty with breast implant. The reason for the liberal administration of therapeutic mammoplasty in frail patients might be the fact that, although women submitted to this oncoplastic procedure have higher complication rates compared with traditional lumpectomy alone, absolute complication rates are very low and it has been shown to be safe to use in older women with breast cancer [18, 46].

In contrast, G8-frail patients were significantly less likely to be offered BR. None of the frail patients undergoing mastectomy had BR, while 76,5% of fit patients were considered fit enough for implant-based reconstruction. This demonstrates that, although the G8 status did not have a noticeable influence on the oncological surgical management, it did interfere with the reconstructive pattern.

The number of postoperative complications was not significantly different between fit and frail patients, although percentually higher in the latter. Nonetheless, we should note that fit patients had 17 BR in 130 breasts operated, 12 of which experienced a complication. In fact, the rate of breast-site and medical complications of reconstructed breasts (66,7%) was almost three times higher compared to that of the overall population (23,6%).

There was also no statistically significant association between frailty and in hospital length of stay, readmission or reintervention between groups. Nonetheless, it is worth noting that none of the frail patients left the hospital at the day of surgery and only these stayed in the hospital for more than 5 days to a maximum of 8 days. In this case, the absence of a statistically significant difference is likely due to the low statistical power resulting from the small sample size for frail patients.

Even if an association between G8 frailty status and mortality can not be establish with our data, we can verify that only one patient died in the entire cohort of 192 patients and this was a frail patient who scored 11 at the G8 screening tool and who underwent mastectomy with no BR.

In our results, the lack of a statistical association between G8 frailty status and postoperative adverse outcomes might be explained by the fact that G8-fit patients had more BR, which have demonstrated to increase the surgical risk for complications. Even so, the complication rate was higher in frail patients and G8 frailty assessment seems to be a useful adjunct method for the decision-making process to whether BR should be offered to an older woman or not.

This study has some limitations. First, as a retrospective study, it is subject to bias related to missing data in medical records, with probably underreported outcomes and patient information and, as a result, we may have underestimated the rate of complications. This may also be the case for the rate of readmissions or mortality, as readmissions in other hospitals or deaths may be lost to follow-up. The risk of selection bias can also be considered, since some elderly patients with small tumors and no need for chemotherapy were not submitted to the G8 screening tool. Second, this study is focused on patients 70 years and older, which are subject to a low rate of BR across different studies. In accordance, very few patients included in this study underwent BR, only one in the frail group, precluding the analysis on the predictive value of the G8 screening tool in postoperative outcomes after BR. A much bigger sample of old patients would be necessary for this purpose. Also, no free flap autologous BR was undertaken in the population studied. Although, this is perceived by clinicians as a high-risk technique in the elderly population, different studies have reported that it is safe in carefully selected patients. Third, this study focused on postoperative complications so that postoperative functional status and prognosis of the patients were not considered.

Despite these limitations, one may use G8 frailty screening to gain insight into surgical patterns and risk for adverse outcomes, thereby providing valuable information for shared decision making. It can also be used to adjust treatment plans in this heterogeneous group of patients. Although further investigations for geriatric screening tools are needed, the present study showed that the G8 can be a possible predictor of complications in older breast cancer patients undergoing surgery.

Conclusions

G8-fit patients ≥ 70 years were more likely to be offered BR than G8-frail patients. Breast-site and medical complications seem to occur more often among elderly frail women undergoing breast oncological surgery than among fit women and G8 frailty screening can be a useful tool to assess suitability for reconstruction. Nonetheless, further studies are needed with bigger sample sizes randomizing patients to different reconstructive techniques and to a "no reconstruction" group, in order to determine which patients should be safely offered BR.

Author contribution All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Patrícia dos Santos Leitão Machado e Costa, Márcio Debiasi, and Bruna da Silva Réus. The first draft of the manuscript was written by Patrícia dos Santos Leitão Machado e Costa and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Ethical statement Hereby, I Patrícia Machado e Costa consciously assure that for the manuscript "Surgical choices and complications in elderly women: A single center retrospective analysis in frail vs. non frail breast cancer patients," the following is fulfilled:

1)This material is the authors' own original work, which has not been previously published elsewhere.
2)The paper is not currently being considered for publication elsewhere.
3)The paper reflects the authors' own research and analysis in a truthful and complete manner.
4)The paper properly credits the meaningful contributions of co-authors and co-researchers.
5)The results are appropriately placed in the context of prior and existing research.
6)All sources used are properly disclosed (correct citation).
7)All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.
8)The manuscript has been read and approved by all named authors.

Ethics approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was not necessary for this retrospective study according to the portuguese law and ethical guidelines.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Conflict of interest Patrícia Machado e Costa, Márcio Debiasi, Bruna da Silva Reus, André Cardoso, David Pinto, Pedro Gouveia, Rogelio Andres-Luna, Carlos Mavioso, João Anacleto, Fátima Cardoso, Maria João Cardoso declare no conflict of interest.

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