# Breast Cancer in Women Aged 80 Years or Older: An Analysis of Treatment Patterns and Disease Outcomes

Erin Ferrigni,[1] Carmen Bergom,[2] Ziyan Yin,[3] Aniko Szabo,[3] Amanda L. Kong[1]

## Abstract

No clear standard treatment guidelines exist for older women with breast cancer. In this study we aimed to examine the practice patterns and treatment outcomes of women ≥80 years old with invasive breast cancer. A retrospective chart review at a single academic institution was performed of 124 women diagnosed with stage I to III invasive breast cancer aged ≥80 years between 2005 and 2014. Median age of diagnosis was 84 years. Fifty-nine of the cancers (48%) were detected using mammography. One hundred twelve patients (90%) underwent surgery. There was no difference in comorbidities between the surgical and nonsurgical group ($P = .800$). In multivariate analysis, age was predictive of receiving surgery ($P < .001$). Overall survival probability was higher for those who received hormonal therapy ($P = .002$), radiation therapy ($P = .041$), and those with lower-stage tumors ($P = .018$). Surgery was not predictive of survival. It is important to consider comorbidities, complications and, longevity when determining whether elderly women diagnosed with breast cancer benefit from surgery.

*Clinical Breast Cancer,* Vol. 19, No. 3, 157-64 
**Keywords:** Breast cancer, Elderly, Surgery, Survival, Treatment

## Introduction

As women are living longer into and past their eighth and ninth decades, more women are being diagnosed with cancer. The risk of developing breast cancer increases with age, peaking in incidence around age 80 years,[1] and elderly women aged 70 years and older comprise approximately 30% of all invasive breast cancer cases.[2] Despite the disease burden of breast cancer in the elderly, there currently exists no clear standard treatment guidelines for older women with invasive breast cancer, and few studies examine the effect that treatment has on overall survival.[3] Moreover, many of the published studies for the elderly breast cancer population often include younger age groups with invasive breast cancer or exclude women older than 80 years old,[4] leading to a paucity of information on treatment patterns for women older than age 80 years affected by invasive breast cancer.[5]

[1]Department of Surgical Oncology
[2]Department of Radiation Oncology
[3]Division of Biostatistics, Medical College of Wisconsin, Milwaukee, WI

Submitted: Oct 4, 2018; Revised: Jan 16, 2019; Accepted: Jan 22, 2019; Epub: Jan 31, 2019

Address for correspondence: Amanda L. Kong, MD, MS, 8701 Watertown Plank Rd, Milwaukee, WI 53226
E-mail contact: akong@mcw.edu

The treatment of elderly women older than age 80 years with breast cancer is often less aggressive and might deviate from standard practices established for younger women.[3] Elderly women are less likely to undergo surgery[6] and are usually excluded from participating in clinical trials,[4] rendering treatment approaches largely on the basis of performance status and comorbidities.[7] Multiple studies have shown that elderly women with invasive breast cancer are not being treated as aggressively as their younger counterparts.[8,9] Additional studies have shown variation in survival and outcomes with less aggressive treatment for elderly women with breast cancer.[10-12] Extrapolation of these studies is also complex, however, because comorbidities, performance status, and longevity must be taken into account.[13]

The purpose of this study was to examine the method of diagnosis, the treatment, and outcomes of elderly women 80 years of age and older with invasive breast cancer. Our goal was to examine the practice patterns including surgery and utilization of adjuvant treatment (chemotherapy, antiendocrine therapy, radiology) and treatment outcomes of women 80 years of age and older with invasive breast cancer at a large academic center.

## Materials and Methods

An institutional review board-approved retrospective chart review was performed to identify patients from 2005 to 2014 who were female and 80 years of age or older with stage I to III invasive breast

1526-8209/$ - see frontmatter 
https://doi.org/10.1016/j.clbc.2019.01.007

cancer within the Froedtert Hospital Tumor Registry in Milwaukee, Wisconsin. Women were not included in the study if their clinical stage was IV or if they had a previous diagnosis of a separate ductal carcinoma in situ or invasive breast cancer before the age of 80. A total of 154 women were identified in the tumor registry. Thirty women were then excluded because of lack of treatment and follow-up information in the medical record.

Data collected included patient socioeconomic status; diagnostic information; tumor characteristics including tumor histology; stage of disease at diagnosis; type of surgery, radiation, or systemic treatments; complications within 3 months of surgical, systemic, and/or radiation therapy; survival status; breast cancer recurrence status; and overall survival. Staging of the tumor was done clinically and pathologically on the basis of the American Joint Committee on Cancer (version VII) Tumor, Node, Metastases system classification.[14]

Comorbidities were assessed using the Charlson Comorbidity Index.[15] Comorbidities were identified via chart review of patient medical records. Complications were assessed within 3 months of surgery, radiation, and/or chemotherapy. Complications were further classified as Grade 1 to 5 according to the National Cancer Institute Common Terminal Criteria for Adverse Events v4.0.[16] Survival status at last date of contact recorded included: alive with no evidence of disease, alive with evidence of disease, dead of other causes, dead of disease, dead with cause unknown, and lost to follow-up.

Descriptive statistics were performed for continuous variables and categorical variables. Kruskal–Wallis and $\chi^2$ tests were applied to evaluate the associated continuous variables and categorical variables, respectively. Logistic and Cox regression was used for multivariate analysis of receipt of surgery and overall survival, respectively. A Kaplan–Meier plot was performed to estimate the overall survival for the cohort according to whether or not they underwent surgery. A log rank test was used to compare overall survival probabilities.

## Results

The final cohort consisted of 124 patients 80 years of age or older diagnosed with invasive breast cancer stages I to III. Median age of diagnosis was 84 (range, 80-99) years. Most of the cancers were detected using mammography (59 patients, 48%), followed by self-palpation (42 patients, 34%; Table 1). Most of the cancers were diagnosed at an early stage (stage I or II). Most tumors were low grade (41 tumors [33%] Grade 1; 59 tumors [48%] Grade 2). Most of the tumors were estrogen receptor (ER)-positive ($ER^+$; 114 tumors [91%]) and 14 tumors (13%) were $HER2^+$.

The majority of patients (112/124, 90%) in this cohort of patients underwent surgery (Table 1). Of those, 82 patients (73%) underwent a lumpectomy, while 30 patients (27%) received a mastectomy. Within the surgical group, 94 patients (76%) underwent axillary surgery: 73 of those patients (78%) underwent a sentinel lymph node biopsy, 15 patients (16%) received an axillary lymph node dissection, and 6 patients (6%) who initially had a sentinel lymph node biopsy were converted to an axillary node dissection. Of those who underwent surgery, 14 patients (12%) required additional excisions for positive or close tumor margins. Pathological staging of tumors revealed 58 (52%) were stage I, 35 (32%) were stage II, and 17 (16%) were stage III. No difference was seen in the number of comorbidities between the surgical and nonsurgical groups ($P = .800$). Only 16 (13%) of the patients received chemotherapy, with 105 (85%) not receiving chemotherapy (6 of these patients refused treatment [5%]). Of the entire cohort, most patients (94/119, 77%) received hormonal therapy and 56 patients (46%) underwent radiation (Table 1).

Of the 12 patients who did not undergo surgery, these patients were more likely to be older with a median age of 91 (range, 83-99; mean age, 90) years. For these patients, self-detection via self-breast examinations was the most common method of tumor detection (8 patients, 66.7%). Like those who received surgery, most tumors were clinical stage I or II (10 tumors, 83%) and were predominantly Grade 1 or 2. Tumors of all 12 patients who did not receive surgery were all $ER^+$ and/or progesterone receptor (PR)-positive (100%). Finally, the women who did not receive surgery had similar comorbidity scores using the Charlson Comorbidity Index compared with the women who did receive surgery (Table 1).

Of those who underwent radiation therapy, the mean age of those who received radiation was 83.7 years. Those who did not receive radiation or refused radiation had a mean age of 85.2 years. Of those who underwent surgery who then received adjuvant radiation therapy, 10/56 patients (17.9%) underwent mastectomy and 46/56 patients underwent lumpectomy (82.1%). The mean Charlson Comorbidity Index score was 4.98 for those who received radiation and 5.1 for those who did not receive radiation. Fifty-two patients (46%) who received surgery were pathological stage II/III. In stage I/II patients who received surgery, 16/52 (31%) received chemotherapy, 6 refused (12%), and the reasons chemotherapy was not administered in the remaining patients was not clear.

Of the patients who received surgery, 20 patients (18%) experienced complications within 3 months of their procedure (Table 2). Seventeen out of 20 (85%) of the adverse events were Grade 1, including complications such as mild postoperative seromas, delayed wound healing, hypersensitive nerve issues, and lymphedema. Of those who experienced Grade I complications, 11 women received a lumpectomy whereas 6 women underwent a mastectomy. Two patients (10%) who underwent a lumpectomy had Grade 2 complications of incision site infection and wound dehiscence requiring the use of antibiotics. One patient who received a mastectomy experienced a Grade 4 complication, which required surgical evacuation of the anterior chest wall because of a hematoma 3 days after initial surgery in a patient taking therapeutic enoxaparin for a history of portal vein thrombosis.

There were 9 cases of systemic chemotherapy complications (6 Grade I/II and 3 Grade III/IV). Chemotherapy complications included instances of neuropathy, hemorrhagic cystitis, decreased ejection fraction, and severe nausea, vomiting, and diarrhea. For 2 patients, side effects from chemotherapy required hospital admission and 1 patient required a blood transfusion for anemia. Fourteen of 16 patients (88%) completed their planned chemotherapy regimen. For 1 patient, chemotherapy was discontinued because of sleep disturbances and neuropathy after 4 of 6 cycles and another patient was still receiving chemotherapy at the time of data collection. Beyond expected mild erythema during radiation therapy (Grade I toxicity), 3 patients had Grade 2 complications related to radiation therapy requiring intervention with antifungals or antibiotics.

**Table 1** Presentation, Diagnosis, Tumor Characteristics, and Treatment Patterns in 124 Women Age 80 Years or Older

| Factor | Total (n = 124) | No Surgery (n = 12) | Surgery (n = 112) | *P* |
|---|---|---|---|---|
| **Age at Diagnosis** | | | | |
| Mean (SD) | 84.6 (3.8) | 89.7 (4.6) | 84.1 (3.3) | <.001 |
| Median (range) | 84.0 (80.0-99.0) | 90.5 (83.0-99.0) | 83.0 (80.0-97.0) | |
| **Comorbidities**[a] | | | | |
| 1-2 | 2 (1.7) | 0 (0.0) | 2 (1.9) | .800 |
| 3-4 | 56 (47.5) | 6 (54.5) | 50 (46.7) | |
| ≥5 | 60 (50.8) | 5 (45.5) | 55 (51.4) | |
| **Diagnosis Method** | | | | |
| Clinical breast exam | 10 (8.1) | 1 (8.3) | 9 (8.0) | .068 |
| Mammogram | 59 (47.6) | 2 (16.7) | 57 (50.9) | |
| Other | 7 (5.6) | 0 (0.0) | 7 (6.3) | |
| Self-detection | 42 (33.9) | 8 (66.7) | 34 (30.4) | |
| Unknown | 6 (4.8) | 1 (8.3) | 5 (4.5) | |
| **Tumor Histology** | | | | |
| Invasive ductal | 102 (82.3) | 10 (83.3) | 92 (82.1) | 1.000 |
| Invasive lobular | 22 (17.7) | 2 (16.7) | 20 (17.9) | |
| **Clinical Stage (TMN)** | | | | |
| I | 70 (57.4) | 5 (41.7) | 65 (59.1) | .285 |
| II | 41 (33.6) | 5 (41.7) | 36 (32.7) | |
| III | 11 (9.0) | 2 (16.7) | 9 (8.2) | |
| **Tumor Grade at Diagnosis** | | | | |
| 1 | 41 (33.3) | 6 (50.0) | 35 (31.5) | .158 |
| 2 | 59 (48.0) | 6 (50.0) | 53 (47.7) | |
| 3 | 23 (18.7) | 0 (0.0) | 23 (20.7) | |
| **Receptor Status (ER and/or PR)** | | | | |
| Negative | 10 (8.1) | 0 (0.0) | 10 (8.9) | .596 |
| Positive | 114 (91.9) | 12 (100.0) | 102 (91.1) | |
| **HER 2/*neu* Status** | | | | |
| Negative | 93 (83.8) | 6 (75.0) | 87 (84.5) | .312 |
| Positive | 14 (12.6) | 1 (12.5) | 13 (12.6) | |
| Equivocal | 4 (3.6) | 1 (12.5) | 3 (2.9) | |
| **Axillary Surgery** | | | | |
| No | 30 (24.2) | — | 18 (16.1) | — |
| Yes | 94 (75.8) | — | 94 (83.9) | |
| **Re-excision**[b] | | | | |
| No | 104 (88.1) | — | 96 (87.3) | — |
| Yes | 14 (11.9) | — | 14 (12.7) | |
| **Chemotherapy** | | | | |
| No/refused | 105 (86.8) | 10 (100.0) | 95 (85.6) | .356 |
| Yes | 16 (13.2) | 0 (0.0) | 16 (14.4) | |
| **Hormone Therapy** | | | | |
| No/refused | 27 (22.7) | 1 (11.1) | 26 (23.6) | .682 |
| Yes | 92 (77.3) | 8 (88.9) | 84 (76.4) | |
| **Radiation Therapy** | | | | |
| No/refused | 65 (53.7) | 10 (100.0) | 55 (49.5) | — |
| Yes | 56 (46.3) | 0 (0.0) | 56 (50.5) | |
| **Final Pathologic Overall** | | | | |
| I | 58 (52.7) | — | 58 (52.7) | — |

**Table 1** Continued

| Factor | Total (n = 124) | No Surgery (n = 12) | Surgery (n = 112) | *P* |
|---|---|---|---|---|
| II | 35 (31.8) | – | 35 (31.8) | |
| III | 17 (15.5) | – | 17 (15.5) | |

Data are presented as n (%) except where otherwise noted.
Kruskal–Wallis tests, F-tests, or Fisher exact test/$\chi^2$ were applied to evaluate for differences between the no surgery and surgery groups for continuous variables or categorical variables.
Abbreviations: ER = estrogen receptor; PR = progesterone receptor.
[a]Comorbidities assessed using the Charlson Comorbidity Index.
[b]Of the patients who required re-excision, 12 patients had received a lumpectomy whereas 2 patients underwent a mastectomy. Of the 2 patients who underwent mastectomy, one patient was found to have positive medial margins whereas the second patient had initially undergone a partial mastectomy and was found to have positive nodes and margins and decided to have additional surgery in the form of a total mastectomy.

The median follow-up for the whole cohort was 40 months. As of the last follow-up date, 48 patients (39%) of the total cohort were alive with no evidence of disease, 8 patients (6%) were alive with breast cancer, and only 6 patients (5%) died from complications of breast cancer. Overall, 25 patients (20%) died of other causes, 17 patients (14%) died from unknown causes, and 20 (16%) patients were lost to follow-up. For the surgery group, median follow-up was 49 months with 48 patients (43%) alive with no evidence of disease and 6 patients (5%) alive with breast cancer. Six patients (5%) who received surgery died from complications related to breast cancer, 20 (19%) died of other causes, 16 (14%) died of unknown causes, and 16 (14%) were lost to follow-up. For the no-surgery group, median follow-up was 26 months with 2 patients (17%) alive with breast cancer, 0 patients died of breast cancer-related causes, 4 patients (33%) died from non-breast cancer-related causes, 2 patients (17%) died from unknown causes, and 4 patients (33%) were lost to follow-up.

Approximately 15 patients (13%) of patients who received surgery experienced a recurrence, and of these, 5 patients (31%) had a local recurrence, 4 patients (25%) had a regional recurrence, and 6 patients (44%) had a distant recurrence. Specifically, 11 women who received a lumpectomy experienced a recurrence (4 local, 3 regional, and 4 distant). Of the women who underwent a mastectomy, 3 experienced a recurrence (1 regional and 2 distant). Median time to recurrence for the whole cohort was 15 months (range, 7-66 months). Of those who experienced a cancer recurrence, 6 of 14 patients (43%) received radiation therapy, 3 of 14 (21%) received chemotherapy, and 10 of 14 (71%) received hormonal therapy. Only 3 of 14 patients received all 3 treatment modalities (radiation, chemotherapy, and hormonal therapy).

Multivariate analysis was performed to determine factors predictive of receiving surgery, including age at diagnosis, clinical stage, diagnostic method of detection, ER/PR and HER2 status, and Charlson Comorbidity Index. Age was the only variable predictive of receiving surgery ($P < .001$; Table 3). Overall survival probability (Figure 1) was significant in those who received surgery compared with those who did not ($P = .01$). However, multivariate analysis revealed that clinical stage ($P = .018$), receipt of hormonal therapy ($P = .002$), and receipt of radiation ($P = .041$) were significant for overall survival, whereas surgery was not predictive of survival in multivariate analysis (Table 4).

**Table 2** Number of Complications With Surgery, Chemotherapy, and Radiation Therapy

| Treatment | Occurrences, n (%) | |
|---|---|---|
| | Grade I/II | Grade III/IV |
| Surgery (n = 112) | 19 (17) | 1 (0.01) |
| Lumpectomy (n = 82) | 13 (12) | 0 (0) |
| Mastectomy (n = 30) | 6 (5) | 1 (0.01) |
| Chemotherapy (n = 16) | 6 (38) | 3 (19) |
| Radiation Therapy (n = 56) | 5 (9) | 0 (0) |

Complications were defined using Common Terminology Criteria for Adverse Events v4.0.

## Discussion

Women 80 years of age and older with breast cancer are less likely to undergo surgery[6] and have more variation in terms of treatments administered than younger patients. In our cohort, we found that a large proportion of octogenarians did receive breast cancer treatment and this group had an overall survival benefit, namely those who received radiation and hormonal therapy (Table 4). In addition, not surprisingly, those patients with lower-stage disease also had better overall survival. Those who underwent surgery were likely to be younger, reflecting physician selection bias in choosing to treat patients with better performance status to receive surgery and other adjuvant treatments. There was no statistical difference between the surgery and nonsurgery groups with respect to histology, clinical stage, tumor grade, receptor status, and Charlson Comorbidity Index. However, the Charlson Comorbidity Index is an imperfect measure to determine whether or not someone is an appropriate surgical candidate. In this study, the Charlson Comorbidity Index provided a surrogate measure for an individual's health status, as we were limited in our ability to use more granular methods to determine potential longevity.

In our study of 124 patients 80 years of age and older with nonmetastatic invasive breast cancer, 59 women (48%) of women were diagnosed via screening mammography and 42 women (34%) were diagnosed via clinical examination. This finding supports other studies that have shown that approximately half of older patients (those 80 years old or older) were diagnosed via mammography,[5] whereas other studies have reported that most of their cohort 80 years of age or older (39%) were diagnosed using a clinical exam[17] and that mammography is underutilized in populations aged 80 or older.[9] The discrepancy between diagnostic methods might relate to a lack of specific screening recommendations for women 80 years of age or older over this time period. In fact, studies on the benefit of breast cancer screening in the elderly population often exclude women older than the age of 75 years.[18,19] Because fewer women older than the age of 80 years receive routine mammographic

**Table 3** Multivariate Analysis for Patients Whose Clinical Tumor Stage (TNM) Was Not IV to Evaluate the Probability of Receiving Surgery

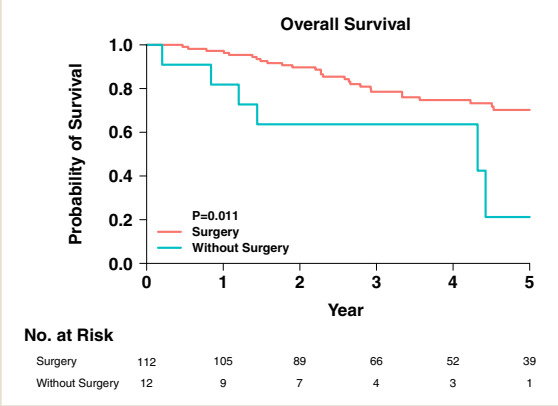
| Parameter | n (n Event); Total n = 124 | OR (95% CI) | *P* | Overall *P* |
|---|---|---|---|---|
| **Age of Diagnosis** | 124 | 0.69 (0.57-0.84) | <.001 | <.001 |
| **Receptor Status (ER and/or PR)** | | | | |
| Positive | 114 (102) | 1.00 | | .962 |
| Negative | 10 (10) | 539,397.11 (0.00 to Inf[a]) | .962 | |
| **Charlson Comorbidity Index** | | | | |
| 1-4 | 58 (52) | 1.00 | | .878 |
| ≥5 | 60 (55) | 1.35 (0.30-6.06) | .696 | |
| Unknown | 6 (5) | 0.75 (0.04-12.79) | .842 | |
| **Clinical TNM Stage** | | | | |
| 1 | 71 (66) | 1.00 | | .621 |
| 2 | 42 (37) | 1.24 (0.26-5.89) | .791 | |
| 3 | 11 (9) | 0.36 (0.04-3.76) | .397 | |

Abbreviations: OR = odds ratio; TNM = Tumor, Node, Metastases.
[a]The confidence interval for this variable approach infinity (Inf).

screening, it has been proposed that elderly women present with more aggressive or higher-risk disease.[20] However, other studies have documented that elderly women have less aggressive disease and a more favorable tumor marker profile ($ER^+$ and/or $PR^+$, HER2/*neu*$^-$, and decreased levels of cell proliferation markers).[21-23] Most of our patients presented with favorable tumor characteristics indicating less aggressive tumors, with 70 tumors (57%) and 41 tumors (34%) having stage I or II disease, respectively, 100 patients (81%) having Grade 1 to 2 tumors, and 114 tumors (92%) having ER and/or PR positivity.

Surgical treatment in elderly women with invasive breast cancer is often influenced by age and associated comorbidities.[5] It has been documented that elderly women are less likely to have breast-conserving surgery and more likely to have a mastectomy.[3-5,7,24-26] In our cohort, 112 patients (90%) of patients underwent surgery (breast and/or axillary). In contrast to other reports, our patients were more likely to undergo breast-conserving surgery (82/112 patients, 73%). This finding is likely because lumpectomy is a less invasive and a less morbid procedure than mastectomy with similar oncologic outcomes. Our findings are similar to those of Evron et al,[8] who reported more than 60% of patients underwent a lumpectomy and 13% received simple mastectomies. Tumor stage might have also influenced the higher percentage of women who received breast-conserving surgery. In our cohort, 111 women (89%) were clinical stage I/II. Other studies have shown similar rates of early stage breast cancer but with mastectomy serving as the predominant procedure for surgical treatment for those studies.[3,7,24] Furthermore, cosmesis might not have been as important when choosing surgical treatment, and surgical decision-making in this cohort might have been influenced more by the health status of the patient. For instance, a mastectomy without reconstruction requires more time in the operating room versus a lumpectomy.

**Figure 1** Kaplan–Meier Curve for Surgery and Overall Survival




Conversely, elderly women with invasive breast cancer have been reported to be less likely to undergo axillary staging procedures[27,28] compared with their younger counterparts.[29] As of July 2016, in their Choosing Wisely guidelines, the Society of Surgical Oncology states that sentinel node biopsies may be safely omitted in clinically node-negative women who are 70 years old or older with low-risk disease. In this age group treatment with hormonal therapy does not result in increased rates of locoregional recurrence and does not affect breast cancer mortality.[30,31] Despite literature stating that axillary surgery in those 70 years of age or older with lower-risk disease might have no effect on overall survival or breast cancer recurrence,[32-34] axillary surgery remains widely used in this age group with studies reporting axillary surgery rates ranging from 45% to 95% from large data sets (2004-2013) before the Choosing Wisely guidelines about axillary surgery in those 70 years old or older.[33,35] The continued use of axillary surgery might be on the basis of studies that have shown sentinel node mapping and biopsies to be influential on subsequent therapy decisions such as chemotherapy.[29] With the institution of the current Choosing Wisely guidelines, it is likely the number of sentinel node biopsies and axillary surgeries in the elderly population will decline with time. For our cohort who underwent surgical treatment, 94 women

**Table 4** Multivariate Analysis of Factors That Might Be Associated With Overall Survival

| Parameter | n (n Event); Total n = 124 | HR (95% CI) | *P* | Overall *P* |
|---|---|---|---|---|
| **Age at Diagnosis** | 124 | 1.07 (0.98-1.17) | .134 | .134 |
| **Receptor Status (ER and/or PR)** | | | | |
| Negative | 10 (5) | 1.00 | | .779 |
| Positive | 114 (43) | 1.17 (0.38-3.62) | .779 | |
| **Chemotherapy** | | | | |
| No/unknown | 108 (44) | 1.00 | | .276 |
| Yes | 16 (4) | 0.52 (0.16-1.68) | .276 | |
| **Clinical TNM Stage** | | | | |
| 1 | 71 (20) | 1.00 | | .018 |
| 2 | 42 (22) | 1.98 (1.03-3.79) | .039 | |
| 3 | 11 (6) | 3.83 (1.37-10.71) | .010 | |
| **Hormone Therapy** | | | | |
| No/unknown | 32 (15) | 1.00 | | .002 |
| Yes | 92 (33) | 0.31 (0.14-0.65) | .002 | |
| **Radiation Therapy** | | | | |
| No/unknown | 68 (27) | 1.00 | | .041 |
| Yes | 56 (21) | 0.49 (0.25-0.97) | .041 | |
| **Surgery** | | | | |
| No | 12 (6) | 1.00 | | .780 |
| Yes | 112 (42) | 0.85 (0.28-2.59) | .780 | |

Abbreviations: ER = estrogen receptor; HR = hazard ratio; PR = progesterone receptor; TNM = Tumor, Node, Metastases.

(84%) underwent some type of axillary staging procedure (sentinel lymph node biopsy or axillary lymph node dissection). Our findings are therefore comparable with those studies in which most patients who received surgical treatment underwent axillary staging.[5,24] The high rate of axillary staging procedures is likely because of the time period of treatment for our cohort (2005-2014), which was before the Choosing Wisely guidelines were published.

It is important to consider the potential risks of surgery and postoperative complications when deciding whether or not a patient is a candidate for breast cancer surgery. One study reported that although 41 of the elderly women with breast cancer (37%) experienced some type of surgical complication, most of these complications were classified as minor.[25] We had similar results showing a relatively low complication rate (20 patients [18%] at 3 months), with most complications requiring no intervention and not interfering with, or only mildly interfering with, patient activities of daily living. A large percentage of our cohort underwent surgery, likely because most patients underwent breast-conserving surgery, which had a low complication rate although half of the patients had a Charlson Comorbidity Index >4. Surgery may be considered when appropriate in elderly women with invasive breast cancer, because it yields acceptable complication rates in most cases, with most events being minor complications, particularly in patients who might not be compliant with systemic therapy.

Chemotherapy was seldom used in our patient population. Compared with younger women with breast cancers with similar tumor biology, elderly women often receive chemotherapy less frequently and at lower doses.[7,36] Reasons for omitting chemotherapy might include expected lifespan, comorbidities, and potential for adverse events. While 8 patients (50%) who received chemotherapy in our cohort experienced complications, 3 of those complications (38%) were considered minor. Therefore, it could be proposed that chemotherapy may be used in older populations, when deemed appropriate and lifespan and quality of life are taken into account.

While 114 (91%) of our patients were hormone receptor-positive, only 92 patients (81%) who were hormone receptor-positive received hormonal treatment. We found of those for whom hormone treatment was indicated, 7 patients (6%) refused treatment. We were not able to determine from reviewing records why the remaining 15 patients (13%) did not receive hormonal therapy. In the no-surgery group, no patients received radiation or chemotherapy, whereas 8 patients (67%) received hormonal therapy. Of the remaining 4 patients in the "no-surgery" group who were hormone receptor-positive, 1 patient did not receive hormone therapy and for the other 3 patients it could not be determined from medical records whether or not they received hormone therapy. Despite that clinical trials have shown an improvement in survival and recurrence rates with hormonal therapy in postmenopausal women,[37] it is also well documented that compliance rates with these medications can be low.[38] As previously reported, it is difficult to ascertain whether these elderly patients are routinely taking these medications and whether it contributes to surival.[39] In the multivariate analysis for survival, hormonal therapy was very significant, showing the importance of systemic therapy for breast cancer whether a patient is a surgical candidate or not.

It has been shown that elderly women with breast cancer are less likely to receive adjuvant radiation therapy.[5,9] However, studies

such as CALGB (Cancer and Leukemia Group B) 9343 have shown that radiation can be safely omitted in older patients (70 years or older) receiving breast conserving surgery and endocrine therapy for small, hormone receptor-positive and node-negative breast cancers, without affecting overall survival.[40,41] van de Water et al[36] reported that for women aged 75 years or older, approximately 50% received radiotherapy, compared with up to 74% in younger patients. In our cohort, 56 women (45%) received radiation therapy as part of their cancer treatment. Although this number might seem high because of the CALGB 9343 findings, it might be attributed to factors such as anticipated life expectancy or patient characteristics. Those women who received radiation therapy in our cohort tended to be slightly younger than the entire cohort with a median age of 83 years old, but had similar comorbidities compared with the whole cohort. Additionally, a slightly larger percentage of the women who received radiation therapy had higher-stage tumors compared with the cohort as a whole (6/56 women [11%] vs. 11/124 women [9%], respectively). It is possible that although the Charlson Comorbidity Index was similar in both groups regardless of receipt of radiation, there are other factors not accounted for in the index that differed between the groups, with those who received radiation having a higher performance status.

We found the main cause of death was often because of other causes besides breast cancer (25/124 [20%] because of other causes, 17/124 [14%] because of unknown causes), with only 6 patients (5%) dying from causes related to their breast cancer. The low death rate caused by breast cancer might be related to tumor biology. Other competing comorbidities might have had a greater effect on patient survival compared with the diagnosis of breast cancer. Of note, for 20 patients (16%), survival status could not be ascertained upon follow-up, which might have also affected the major cause of death in the cohort. Compared with the literature, other studies have also shown that causes other than breast cancer become more important as causes of death with increasing age.[5,42]

Limitations of this study include the retrospective nature of the study and therefore, the inability to determine particular reasons for omission of certain therapies for patients such as chemotherapy. Because patients in this study were only from 1 academic institution, and this was a relatively small number of patients, the results might be difficult to generalize to other populations. However, our institution is situated such that the patient mix is from urban and suburban areas. In addition to standard tumor factors such as receptor status, tumor grade, and stage, we were also able to determine the comorbidity status of our patients which is an important factor when assessing whether a patient is a surgical candidate and whether or not to administer adjuvant therapy. Half of our cohort had a Charlson Comorbidity Index of $\geq$5, showing that our findings are also applicable to patients with a number of comorbidities. Another strength of our study was our ability to examine the complication rates of specific treatments and details of each complication on a more granular level than is possible in larger database studies.

## Conclusion

Herein we report on the treatment and outcomes for women 80 years of age or older with nonmetastatic invasive breast cancer at a large academic center. In this cohort, patients who were younger, with image-detected tumors, were more likely to undergo surgery. We also showed that patients with early stage disease who received hormonal therapy and/or radiation therapy were more likely to survive, particularly those who received hormonal therapy. Because of the low frequency of complications with surgery, radiation, or chemotherapy, including these therapies as standard of care for octogenarians who have few comorbidities and reasonable longevity should be considered. Further analysis of treatment outcomes in this patient population is warranted to determine a standard multidisciplinary approach to breast cancer treatment for elderly patients.

## Disclosure

The authors have stated that they have no conflicts of interest.

## References


1. Rao VS, Jameel JK, Mahapatra TK, et al. Surgery is associated with lower morbidity and longer survival in elderly breast cancer patients over 80. *Breast J* 2007; 13:368-73.
2. American Cancer Society. *Breast Cancer Facts & Figures 2015-2016*. Atlanta: American Cancer Society, Inc; 2015:1-38.
3. Angarita FA, Chesney T, Elser C, et al. Treatment patterns of elderly breast cancer patients at two Canadian cancer centres. *Eur J Surg Oncol* 2015; 41:625-34.
4. Hutchins LF, Unger JM, Crowley JJ, et al. Underrepresentation of patients 65 years of age or older in cancer-treatment trials. *N Engl J Med* 1999; 341:2061-7.
5. Cyr A, Gillanders WE, Aft RL, et al. Breast cancer in elderly women ($\geq$ 80 years): variation in standard of care? *J Surg Oncol* 2011; 103:201-6.
6. Dialla PO, Dabakuyo TS, Marilier S, et al. Population-based study of breast cancer in older women: prognostic factors of relative survival and predictors of treatment. *BMC Cancer* 2012; 12:1-10.
7. Bouchardy C, Rapiti E, Fioretta G, et al. Undertreatment strongly decreases prognosis of breast cancer in elderly women. *J Clin Oncol* 2003; 21:3580-7.
8. Evron E, Goldberg H, Kuzmin A, et al. Breast cancer in octogenarians. *Cancer* 2006; 106:1664-8.
9. Litvak DA, Arora R. Treatment of elderly breast cancer patients in a community hospital setting. *Arch Surg* 2006; 141:985-90.
10. Yood MU, Owusu C, Buist DS, et al. Mortality impact of less-than-standard therapy in older breast cancer patients. *J Am Coll Surg* 2008; 206:66-75.
11. Diab SG, Elledge RM, Clark GM. Tumor characteristics and clinical outcome of elderly women with breast cancer. *J Natl Cancer Inst* 2000; 92:550-6.
12. Rocco N, Rispoli C, Pagano G, et al. Undertreatment of breast cancer in the elderly. *BMC Surg* 2013; 13:1-6.
13. Balducci L. Treating elderly patients with hormone sensitive breast cancer: what do the data show? *Cancer Treat Rev* 2009; 35:47-56.
14. Edge SB, Byrd DR, Compton CC, et al. *AJCC Cancer Staging Manual*. 7th edition. New York City, New York: Springer; 2010.
15. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987; 40:373-83.
16. NCI Common terminology criteria for adverse events v4.0, Available at: https://ctep.cancer.gov/protocoldevelopment/electronic_applications/ctc.htm#ctc_40. Accessed: December 20, 2017.
17. Vetter M, Huang JD, Bosshard G, Güth U. Breast cancer in women 80 years of age and older: a comprehensive analysis of underreported entity. *Acta Oncol* 2013; 52:57-65.
18. Siu AL, US Preventive Services Task Force. Screening for breast cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med* 2009; 151:716-26.
19. Braithwaite D, Demb J, Henderson LM. Optimal breast cancer screening strategies in older women: current perspectives. *Clin Interv Aging* 2016; 11:111-25.
20. Okonji DO, Sinha R, Philips I, et al. Comprehensive geriatric assessment in 326 older women with early breast cancer. *Br J Cancer* 2017; 117:925-31.
21. Pappo I, Karni T, Sandbank J, et al. Breast cancer in the elderly: histological, hormonal and surgical characteristics. *Breast* 2007; 16:60-7.
22. Syed BM, Green AR, Paish EC, et al. Biology of primary breast cancer in older women treated by surgery: with correlation with long-term clinical outcome and comparison with their younger counterparts. *Br J Cancer* 2013; 108:1042-51.
23. Laki F, Kirova YM, Savignoni A, et al. Management of operable invasive breast cancer in women over the age of 70: long-term results of a large-scale single institution experience. *Ann Surg Oncol* 2010; 17:1530-8.
24. Besic N, Besic H, Barbara P, et al. Surgical treatment of breast cancer in patients aged 80 years or older: how much is enough? *BMC Cancer* 2014; 14:1-7.
25. Chatzidaki P, Mellos C, Briese V, et al. Perioperative complications of breast cancer surgery in elderly women ($\geq$80 years). *Ann Surg Oncol* 2011; 18:923-31.
26. Joerger M, Thürlimann B, Savidan A, et al. Treatment of breast cancer in the elderly: a prospective, population-based Swiss study. *J Geriatr Oncol* 2013; 4:39-47.

27. Edge SB, Gold K, Berg CD, et al. Patient and provider characteristics with stage I-II breast carcinoma. *Cancer* 2002; 94:2534-41.
28. Louwman WJ, Vulto JC, Verhoeven RH, et al. Clinical epidemiology of breast cancer in the elderly. *Eur J Cancer* 2007; 43:2242-52.
29. McMahon L, Gray R, Pockaj B. Is breast cancer sentinel lymph node mapping valuable for patients in their seventies and beyond? *Am J Surg* 2005; 190:366-70.
30. Choosing Wisely. Society of Surgical Oncology. Don't routinely use sentinel node biopsy in clinically node negative women ≥70 years of age with hormone receptor positive invasive breast cancer, Available at: http://www.choosingwisely.org/clinician-lists/sso-sentinel-node-biopsy-in-node-negative-women-70-and-over/. Accessed April 10, 2018.
31. Welsh JL, Hoskin TL, Day CN, et al. Predicting nodal positivity in women 70 years of age and older with hormone receptor-positive breast cancer to aid incorporation of a Society of Surgical Oncology choosing wisely guideline into clinical practice. *Ann Surg Oncol* 2017; 24:2881-8.
32. Liang S, Hallet J, Simpson JS, et al. Omission of axillary staging in elderly patients with early stage breast cancer impacts regional control but not survival: a systematic review and meta-analysis. *J Geriatr Oncol* 2017; 8:140-7.
33. Pesce C, Czechura T, Winchester DJ, et al. Axillary surgery among estrogen receptor positive women 70 years of age or older with clinical stage I breast cancer, 2004-2010: a report from the National Cancer Database. *Ann Surg Oncol* 2013; 20:3259-65.
34. Javid SH, He H, Korde LA, et al. Predictors and outcomes of completion axillary node dissection among older breast cancer patients. *Ann Surg Oncol* 2014; 21:2172-80.
35. Dominici LS, Sineshaw HM, Jemal A, et al. Patterns of axillary evaluation in older patients with breast cancer and associations with adjuvant therapy receipt. *Breast Cancer Res Treat* 2018; 167:555-66.
36. van de Water W, Markopoulos C, van de Velde CJ, et al. Association between age at diagnosis and disease-specific mortality among postmenopausal women with hormone receptor-positive breast cancer. *JAMA* 2012; 307:590-7.
37. Cuzick J, Sestak I, Baum M, et al. Effect of anastrozole and tamoxifen as adjuvant treatment for early-stage breast cancer: 10-year analysis of the ATAC trial. *Lancet Oncol* 2010; 11:1135-41.
38. Ziller V, Kalder M, Albert U, et al. Adherence to adjuvant endocrine therapy in postmenopausal women with breast cancer. *Ann Oncol* 2009; 20:431-6.
39. World Health Organization. *Adherence to Long-Term Therapies; Evidence for Action*. Geneva: WHO; 2003.
40. Hughes KS, Schnaper LA, Berry D, et al. Lumpectomy plus tamoxifen with or without irradiation in women 70 years of age or older with early breast cancer. *N Engl J Med* 2004; 351:971-7.
41. Kunkler IH, Williams LH, Jack WJ, et al. Breast-conserving surgery with or without irradiation in women aged 65 years or older with early breast cancer (PRIME II): a randomized controlled trial. *Lancet Oncol* 2015; 16:266-73.
42. Colanzi E, Liljegren A, Johansson AL, et al. Prognosis of patients with breast cancer: causes of death and effects of time since diagnosis, age, and tumor characteristics. *J Clin Oncol* 2011; 29:4014-21.