Published in final edited form as:

Ann Surg Oncol. 2024 October ; 31(11): 7498–7507. doi:10.1245/s10434-024-15703-0.

Nodal surgery for patients ≥70 undergoing mastectomy for DCIS? Choose Wisely

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Abstract

BACKGROUND: Routine sentinel lymphadenectomy (SLNB) for early-stage HR+/HER2− breast cancer in women ≥70 is discouraged by Choosing Wisely, but whether SLNB can be routinely omitted in women ≥70 with DCIS undergoing mastectomy is unclear. This study aims to evaluate rates of axillary surgery and nodal positivity (pN+) in this population to determine the impact of axillary surgery on treatment decisions.

METHODS: Females ≥70 with DCIS undergoing mastectomy were identified from the National Cancer Database (2012–2020). The rate of upstaging to invasive cancer (≥pT1) or pN+ was assessed. Subset analyses were conducted for ER+ patients. Adjuvant therapies were evaluated among ≥pT1 patients after stratifying by nodal status.

RESULTS: Of 9,030 patients, 1,896 (21%) upstaged to ≥pT1. Axillary surgery was performed in 86% of patients, predominantly sentinel lymphadenectomy (SLNB, 65%). Post hoc application of Choosing Wisely criteria demonstrated that 93% of the entire cohort and 97% of ER+ DCIS patients could have avoided axillary surgery. Nodal positivity was 0.3% among those who didn't upstage, and 12% among those upstaging to ≥pT1, with <2% having pN2–3 disease, irrespective of receptor subtype. Node-positive patients had higher adjuvant therapy usage, but there was no recommendation for adjuvant chemotherapy or radiation for 71% and 66% of pN+ patients, respectively.

CONCLUSIONS: Axillary surgery can be omitted for most patients ≥70 undergoing mastectomy for ER+ DCIS, aligning with recommendations for invasive cancer, and omission can be considered in those with ER- disease. Future guidelines incorporating preoperative imaging, as in the SOUND trial, may aid in identifying patients benefiting from axillary surgery.

Keywords

Mastectomy; Ductal Carcinoma in Situ; Sentinel Lymphadenectomy; Elderly; Upstaging; Omission

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Disclosures: Richard J. Bleicher, Allison A. Aggon, Andrea T. Porpiglia, and Austin D. Williams are consultants for Elucent Medical (Eden Prairie, MN)

Introduction

Knowledge of nodal involvement is important for breast cancer prognosis and to inform adjuvant therapies, and for this reason sentinel lymphadenectomy (SLNB) is standard for most clinically node-negative patients. Ductal carcinoma *in situ* (DCIS) lacks the ability to spread, and thus SLNB is superfluous to the surgical management for many patients. Due to limitations of core needle biopsy of breast lesions, there is an approximate 20% chance of upstage from DCIS to invasive cancer on final pathology. For patients undergoing breast conserving surgery (BCS), SLNB can be performed at a later date if invasive cancer is found. However, since axillary mapping and SLNB are unable to accurately be performed after mastectomy, concurrent SLNB is recommended for patients undergoing mastectomy for DCIS. [1,2]

While SLNB is safe and less morbid than axillary lymph node dissection (ALND), it is not without side effects. Risks of axillary surgery include pain, seroma, paresthesias, impaired range of motion, axillary web syndrome (cording), and lymphedema.[3,4,5] Given the potential morbidity, and as part of the goal of de-escalating low value care, the Society of Surgical Oncology and the Choosing Wisely Campaign formulated a recommendation in 2016 for omission of sentinel lymphadenectomy for patients who are unlikely to benefit from the procedure.[6] Specifically, they recommended against routine use of SLNB in clinically node-negative women ≥70 years of age with early-stage hormone receptor positive (HR+), human epidermal growth factor receptor 2 negative (HER2-) invasive breast cancer. This recommendation is based on studies that have found that omission does not result in increased rates of locoregional recurrence and does not impact breast cancer mortality.[7,8]

Given the paradox between the Choosing Wisely recommendation for omission of SLNB in patients with invasive disease, and our current practice of SLNB in those undergoing mastectomy for DCIS, we designed this study to ask what the potential impact of SLNB omission might be for older patients undergoing mastectomy for DCIS. The aims of this study were to assess the trends of axillary surgery in these patients, assess the rates of upgrade to invasive cancer and nodal positivity, and to estimate the impact that performing or omitting axillary surgery might have on adjuvant therapies.

Methods

After Institutional Review Board (IRB) approval, we performed a retrospective analysis of the National Cancer Database (NCDB). The NCDB is a joint collaboration between the American College of Surgeons and the American Cancer Society in which patient-level data are collected from all cancer patients seen at Commission on Cancer accredited programs,[9] representing approximately 70% of United States cancer cases.[10]

From the NCDB breast participant user file (PUF) we identified female patients aged ≥70 years at the time of clinical diagnosis of DCIS who underwent mastectomy as their primary surgical treatment between 2012 and 2020. We excluded patients with clinically invasive cancer (including microinvasion), those who were clinically node positive, if this diagnosis

was not their first cancer, and if there was an unknown pathologic T stage or primary surgery type.

We evaluated the use of axillary surgery over the study period, the rate of upstage to invasive cancer (≥pT1) for all patients, and the rate of upstage to nodal positivity (pN+) among patients who underwent axillary surgery. We then compared rates of nodal positivity stratified by receptor subtype and identified factors independently associated with nodal positivity. Based on rates of upstage and receptor subtype, we applied Choosing Wisely criteria *post hoc* to determine the proportion of patients who could avoid axillary surgery. Finally, the rates of recommendation and receipt of adjuvant therapies (endocrine therapy, chemotherapy and radiotherapy) in patients with HR+HER2− invasive cancer were assessed after patients were stratified by nodal positivity to estimate its impact on adjuvant therapy use.

Statistical Analysis

Comparisons between groups were made using Chi-squared test, Student's t-test, and ANOVA, as appropriate. Univariate and multivariable logistic regression models, adjusting for pertinent clinicopathologic and demographic features, were performed. Statistical tests were two-sided, and a p-value<0.05 was considered statistically significant. Analyses were performed using SAS 9.4 (SAS Institute, Cary, NC).

Results

Study Cohort

We identified 9,030 women ≥70 who underwent mastectomy for DCIS between 2012 and 2020, of whom 21% upstaged to invasive cancer (≥pT1) on final pathology (Table 1). The mean age of the cohort was 75 years, most patients were White (72%), had a Charleson/Deyo score of 0 (73%), and had estrogen receptor (ER)-positive DCIS (73%). Upon univariate and multivariable analysis (adjusting for pertinent clinicopathologic features), factors independently associated with upstage were older age, treatment at a center other than a Community Cancer Center, ER or PR negativity and higher tumor grade differentiation (all p<0.05, Supplementary Table 1).

Current Use of Axillary Surgery

In the overall cohort, only 14% of patients were spared axillary surgery while 65% underwent SLNB and 21% underwent ALND (one third of whom had upfront ALND without SLNB performed first, Table 1). When trends of axillary surgical approach were compared (Figure 1), we observed that the use of SLNB increased by 40% over the study period with a concurrent decrease in the use of other approaches (p<0.001). The rate of omission of axillary surgery and SLNB with completion ALND both decreased by 34% while the rate of upfront ALND decreased by 74%. There was no apparent impact of the Choosing Wisely recommendation release in 2016 on these trends. When axillary surgical approach was analyzed in subgroups according to final pathology, twice as many patients with pTis avoided axillary surgery when compared with ≥pT1 (16 vs. 7%, p<0.001). Over the study period, patients who upstaged to ≥pT1 were more likely to undergo ALND

(24.7%), but 20% of pTis patients underwent ALND (with a similar one-third of patients having upfront ALND without SLNB performed first; p<0.001).

We created univariate and multivariable logistic regression models to assess factors associated with the use of axillary surgery in these patients (Supplementary Table 2). After adjusting for pertinent clinicopathologic features, the factors independently associated with the use of axillary surgery were treatment at a center other than a Community Cancer Center, high grade and upstaging to ≥pT1 while older age and Asian race were associated with omission of axillary surgery (all p<0.05). Of note ER-positivity was associated with omission of axillary surgery on univariate analysis (OR 0.72, 95% CI 0.62–0.83, p<0.001) but did not maintain its association on multivariable analysis (OR 0.78, 95% CI 0.58–1.04, p=0.09).

Nodal Burden and Need for Axillary Surgery

Of the 7,718 patients who underwent axillary surgery, a minority (23%) upstaged to ≥pT1 (Table 2). Of the 5,957 patients with pTis, only 0.3% had positive nodes. Of the 1,761 patients whose primary tumor was upstaged, 87% were pathologically node negative (n=1,530). Most patients with invasive cancer who were found to have positive nodes were pN1 (n=190, 11%) and fewer than 2% had N2–3 (n=30). The mean tumor size was 1.3 cm (+/− 5.1cm) and median was 0.6cm. Only an exceedingly small percentage of patients who did upstage (less than 2%) had 4 or more positive nodes for whom axillary dissection would be warranted.

Given that Choosing Wisely recommendations are applicable only to patients with HR+/HER2− disease, we analyzed nodal status after stratifying by invasive tumor subtype for patients who upstaged to ≥pT1 (Table 3). Overall, 86% of these patients were pathologically node negative (pN0), 12.3% had 1–3 positive lymph nodes, and only <2% had 4 or more positive nodes. There was no difference in pathologic nodal stage between the receptor subtypes with the majority of patients with invasive cancer being pN0 (HR+/HER2: 87%, HER2+: 83%, triple negative: 85%, p=0.27).

We then created univariate and multivariable logistic regression models to assess factors associated with nodal upstaging from cN0 to pN+ among patients undergoing axillary surgery who upstaged to ≥pT1 (Table 4). On univariate analysis, Black race, Hispanic ethnicity, moderate to poor differentiation, and lymphovascular invasion were factors associated with nodal positivity. On multivariable analysis (after adjusting for pertinent clinicopathologic features), we found that Hispanic ethnicity (OR 2.61, 95% CI 1.11–6.13, p=0.03), high tumor grade (OR 2.87 95% CI 1.47–5.62, p<0.001), and presence of lymphovascular invasion (OR 12.86, 95% CI 7.56–21.27, p<0.001) were independent predictors of nodal positivity.

In order to assess the proportion of patients for whom axillary surgery is or is not indicated, we stratified patients by ER-positivity, upstaging and HER2 status, then applied Choosing Wisely criteria *post hoc* (Figure 2). Only 25% of patients had ER- DCIS, and a minority of these patients (n=485, 6% of the entire cohort) upstaged to ≥pT1 for whom axillary surgery would be indicated. Of the remaining patients with ER+ DCIS, a minority upstaged to ≥pT1

(n=1,384, 16% of the entire cohort). Most of these patients (n=1,023, 12% of the entire cohort) had HER2− invasive cancer, and thus met Choosing Wisely criteria for omission of axillary surgery. [Note: only 20 of these patients (0.3% of the entire cohort) upstaged to pT3–4 invasive cancers and would not meet these criteria while 70 (0.8% of the entire cohort) had pT2 tumors that could be considered borderline candidates.] Only 168 patients (2% of the entire cohort) had HR+/HER2+ invasive cancer, and thus would not meet criteria for omission. Therefore, based on final pathology, only 8% of patients would require axillary surgery, with the balance meeting criteria for omission since they did not upstage to invasive cancer or met Choosing Wisely criteria.

Impact of Nodal Positivity on Adjuvant Therapy

Finally, we assessed the impact of nodal positivity on recommendations for adjuvant therapy among the patients who upstaged to ER+HER2− invasive cancer (who meet Choosing Wisely criteria, Table 5). We evaluated rates of recommendation and receipt of adjuvant chemotherapy, endocrine therapy, and radiation. When compared to patients who were node-negative, patients who were node-positive were more likely to receive or were recommend to receive chemotherapy (28.6% vs. 4.9%, $p<0.001$), endocrine therapy (>88% vs. 70%, $p<0.001$) and radiation (>26% vs. 3.7%, $p<0.001$). Despite this difference, most node-positive patients were not recommended to receive chemotherapy (71%) and radiation (66%).

Discussion

Axillary surgery is currently overused in women ≥70 who undergo mastectomy for DCIS, with 88% of women in our cohort undergoing axillary surgery compared with only 8% ultimately requiring it. This study identified factors associated with upstaging to ≥pT1 and pN+ (specifically high grade for both) that may be useful in identifying patients at risk for being node positive and in whom SLNB should be considered.

Currently reported rates of upstaging from DCIS to invasive cancer on final pathology range from 17–36%[11,12,13]; our rate of 21% is consistent with the published literature. Additionally, of the 5,957 patients with DCIS on final pathology, 0.3% were found to have positive nodes, also consistent with sentinel node positivity in studies in the setting of pTis (range 0–6%).[14,15,16,17]

The Choosing Wisely guideline for omission of SLNB in early stage clinically node negative breast cancer has been widely accepted with reproducible results.[18] Prior studies have demonstrated that elderly patients with early breast cancer and clinically negative nodes did not experience any breast cancer survival benefit as a result of axillary surgery.[19,20] A 2021 study by Matar et al. also showed that among women ≥70 undergoing mastectomy and SLNB for DCIS or cT1N0 HR+/HER2− breast cancer, locoregional recurrence-free survival was no different between women with and without axillary nodal metastases.[21] These findings, added to the low proportion of patients in our study who would require axillary surgery based on guidelines, suggest that omission of axillary surgery among these patients would not impact rates of locoregional recurrence and breast cancer mortality.

In our analysis, the rates of omission of axillary surgery were double in patients with pTis when compared to ≥pT1, reflecting the current practice of using favorable clinicopathologic characteristics to select patients appropriate for omission. Though the use of ALND in these patients decreased over the study period, a concerning 20% of patients whose final pathology remained non-invasive underwent unnecessary ALND. While the less invasive SLNB confers a 3–10% risk of axillary paresthesias, impaired upper extremity range of motion, pain, and/or lymphedema,[22] ALND is associated with a 20% risk of lymphedema.[23] Based on current case composition, the overall incidence of lymphedema from axillary surgery for breast cancer remains between 6–10%[24]. Using even this most conservative rate, we estimate that there were at least 481 of the 8,716 women in our cohort who developed lymphedema as a result of unnecessary axillary surgery. While our cohort is composed of patients ≥70 with a limited life span in which to experience surgical morbidity, lymphedema can become clinically evident in as little as 6 months,[25] putting older patients with already-diminished physical capability at risk for worsening quality of life and other injuries. We would also expect many women to suffer from axillary web syndrome, paresthesia, pain, impaired range of motion, and seroma, which could all be circumvented if the procedure were omitted.

One critique of surgical de-escalation is that the lack of information about the true extent of disease results in inadequate adjuvant therapy, potentially compromising outcomes. While we found higher rates of recommendation and receipt of adjuvant chemotherapy, endocrine therapy and radiation among patients who were node-positive than those who were node-negative, we also found that most of these patients (≥66%) are not recommended to undergo these treatments in current practice, calling into question the impact that nodal positivity has on recommendations for systemic therapy in this population. These observations likely reflect care teams taking a more holistic view of risk and benefit of adjuvant therapies, and de-escalating therapy even when disease may dictate a more aggressive approach. While some studies suggest undertreatment impacts breast cancer outcomes among older patients,[26,27,28] others call this into question. A study by Gajdos, et al. found that adjuvant undertreatment of patients ≥70 did not result in diminished outcomes when compared with conventionally-treated elderly patients.[29] An analysis of the Netherlands Cancer Registry demonstrated a decrease in the rates of adjuvant therapies among older breast cancer patients did not impact their relative survival in contrast to younger patients.[30] Similarly, a Canadian registry trial demonstrated that omission of axillary surgery was associated with a decrease in the use of adjuvant therapies in older patients and, while omission was associated with inferior overall survival, there was no difference in breast cancer-specific outcomes, likely reflecting a selection bias.[31] These mixed results warrant further investigation, and highlight the importance of individualized decision making.

Our analysis somewhat unexpectedly showed no difference in nodal stage when patients with invasive cancer were stratified by receptor subtype with ≥80% of patients being pN0. While ER (and often PR) are the only receptors analyzed on core biopsies of DCIS, and despite the receptor-specific Choosing Wisely guidelines, these findings may suggest that receptor subtype (specifically ER-) need not be considered in management of the axilla for women with DCIS undergoing mastectomy. This may be especially pertinent for patients who lack other features suggestive of upstage. Part of the consideration for

omission of SLNB is that patients with HR+ cancers can be effectively treated adjuvantly with endocrine therapy. Recent studies have demonstrated extrapolation of the Choosing Wisely guidelines to “higher risk” cancers, including those found to be invasive lobular carcinoma, or HER2+.[32,33] Performance of nodal surgery in the setting of triple negative cancers remains standard to inform adjuvant therapy recommendations since these patients are unable to be effectively treated with endocrine therapy. However, the small risk of medical undertreatment for these patients if SLNB is omitted should be weighed against the risks of surgery to develop a personalized approach for each patient.

In addition to the consideration of factors predictive of upstaging, another useful preoperative adjunct in this cohort may be axillary ultrasound. Previous studies have demonstrated the ability of axillary ultrasound to reliably identify pN2–3 disease in the preoperative setting.[34,35] More recently, the Sentinel Node vs Observation After Axillary Ultra-Sound (SOUND) randomized clinical trial reported noninferiority of omission of axillary surgery to SLNB in women with early breast cancer with a negative preoperative axillary ultrasound, with median follow up of 5.7 years.[36] These findings suggest that patients with invasive breast cancer <2 cm and a negative preoperative axillary ultrasound can be spared axillary surgery. Additionally, a recent retrospective study of patients with DCIS who underwent mastectomy by Bae et al. identified a very low rate of axillary metastasis in patients with no suspicious axillary lymph nodes on radiologic evaluation.[37] Based on these studies, and the results of our analysis, we suggest that for those patients with DCIS and factors associated with upstaging, preoperative axillary ultrasound be used to assist in determining the utility of SLNB, or reassurance in omission, for that specific patient. The use of preoperative axillary ultrasound may even extend to patients <70 undergoing mastectomy for DCIS, though this is out of the scope the data analyzed in our study.

Alternatively, delayed SLNB could be considered for patients at risk of upstage and nodal positivity if results of SLNB would potentially alter adjuvant treatment. In the SentiNot study, superparamagnetic iron oxide nanoparticles were injected at the time of breast surgery, with a return to the operating room for SLNB only if surgical pathology indicated need for nodal sampling.[38] Though delayed SLNB appears to be a promising technique in some situations, only one third of patients in the SentiNot study underwent mastectomy, and in that setting the sentinel node detection rate was only 80%, so, further work is needed to understand the accuracy of this technique prior to recommendation of its use in these patients. Given the significant related expense of this strategy for centers not currently employing it, and the lack of specific implications of nodal positivity when SLNB is performed, delayed SLNB does not currently seem to be the best universal strategy for patients ≥70 undergoing mastectomy for DCIS.

[22232425]Our study has several strengths and limitations. First, the use of the NCDB, a large, diverse database that reflects current surgical practice, permitted us to evaluate the current use of axillary surgery and discern how much of this constitutes overtreatment. Notable limitations to this study include the inability to incorporate the size of the clinical DCIS into models predictive of upstaging due to lack of data. Recurrence data is also unavailable in the NCDB, which prevents analysis of the value of axillary surgery as it

relates to locoregional recurrence in those patients who had invasive disease identified on surgical pathology. Additionally, while not recommended, some surgeons may attempt sentinel lymphadenectomy after mastectomy and the database does not permit us to analyze the timing of nodal surgery to exclude these cases. Another limitation was the small number of patients who upstaged to pN1 HR+/HER2− cancer for whom genomic testing results were available, precluding analysis. Since the RxPONDER trial showed no benefit to chemotherapy in postmenopausal women with HR+/HER2− breast cancer with a Recurrence Score (RS) of ≤25 and up to 3 positive lymph nodes,[39] future analyses of the RS distribution in this cohort may provide even more evidence to support omission of axillary surgery.

Conclusion

Surgeons are currently overusing axillary surgery in patients ≥70 undergoing mastectomy for DCIS. We can choose more wisely by omitting axillary surgery in this patient population, particularly for patients with low-risk features such as ER positivity and low tumor grade, and we recommend routine omission of axillary surgery for these patients. In patients with ER negativity, consideration for omission can be further informed with a negative preoperative axillary ultrasound. By incorporating clinical, demographic, and pathologic features associated with upstage and nodal positivity, patients can be selected who may still benefit from surgical axillary staging.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

The NCDB is a joint project of the Commission on Cancer of the American College of Surgeons and the American Cancer Society. The data used in the study are derived from a de-identified NCDB file. The American College of Surgeons and the Commission on Cancer have not verified and are not responsible for the analytic or statistical methodology employed or the conclusions drawn from these data by the investigators.

This work was supported by United States Public Health Services grant P30CA006927 for analysis of the data via support of our biostatistics facility and by generous private donor support from the Marlyn Fein Chapter of the Fox Chase Cancer Center Board of Associates for analysis and interpretation of the data.

This work was presented as a poster at the 2024 American Society of Breast Surgeons Annual Meeting and won second prize at the 2024 Philadelphia Academy of Surgery Chris Tzarnas Research Paper Competition.

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Synopsis

Axillary surgery is overused in current practice for patients ≥70 undergoing mastectomy for DCIS. The rate of nodal positivity is less than 4% and does not have significant impact on adjuvant treatments. Omission should be considered.

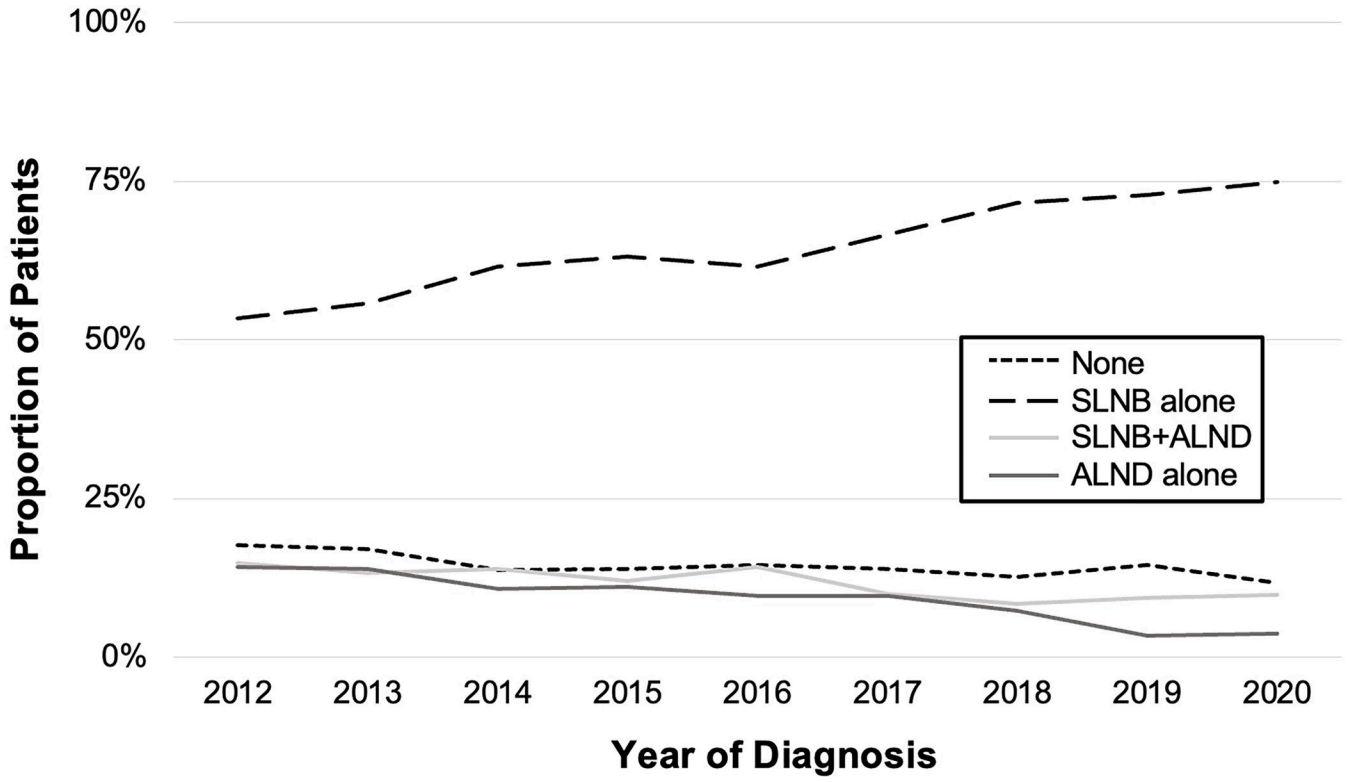

Figure 1:
Axillary surgery over time among patients ≥70 with cTis undergoing mastectomy

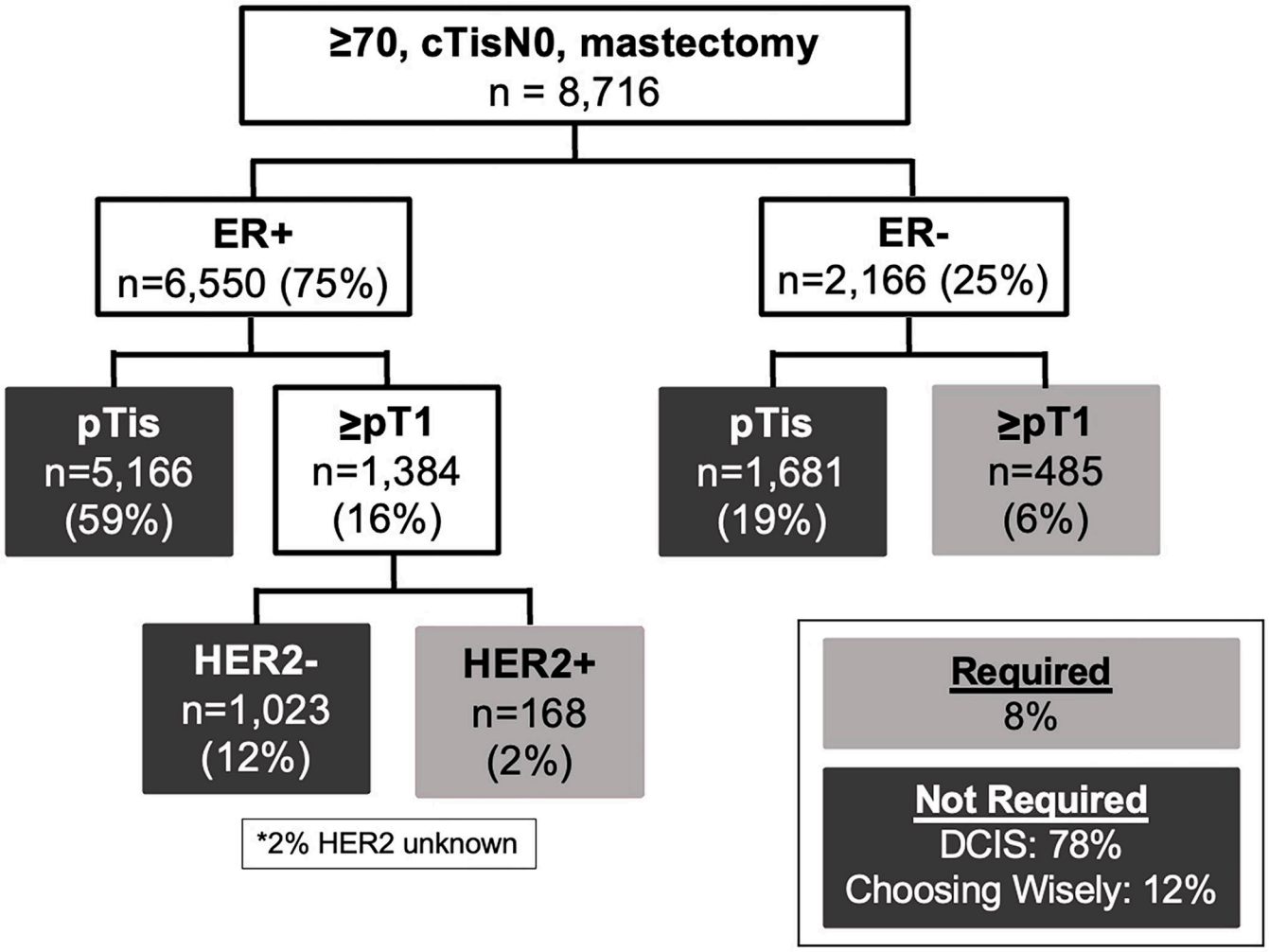

Figure 2:

*Post hoc a*pplication of Choosing Wisely recommendations to patient cohort to discern the proportion of patients in whom axillary surgery would be required.

Table 1:

Clinicopathologic and demographic features of patients ≥70 undergoing mastectomy for clinical DCIS stratified by pathologic tumor stage.

	Overall	pTis	≥pT1	p
n	9,030	7,135	1,895	
Age (years), mean ± SD	75.32 ± 4.63	75.23 ± 4.59	75.67 ± 4.78	<0.001
Race/Ethnicity				
NH White	6,478 (71.7)	5,136 (72.0)	1,342 (70.8)	
NH Black	1,295 (14.3)	1,027 (14.4)	268 (14.1)	
Hispanic	460 (5.1)	364 (5.1)	96 (5.1)	0.04
Asian	515 (5.7)	379 (5.3)	136 (7.2)	
Other/Unknown	282 (3.1)	229 (3.2)	53 (2.8)	
Charlson/Deyo Score				
0	6,565 (72.7)	5,200 (72.9)	1,365 (72.0)	
1	1,717 (19.0)	1,387 (19.4)	330 (17.4)	<0.001
2	472 (5.2)	351 (4.9)	121 (6.4)	
≥3	276 (3.1)	197 (2.8)	79 (4.2)	
Insurance Status				
Not Insured	35 (0.4)	26 (0.4)	*	
Private Insurance	935 (10.4)	754 (10.6)	181 (9.6)	
Medicaid	177 (2.0)	136 (1.9)	41 (2.2)	0.33
Medicare	7,761 (86.0)	6,115 (85.7)	1,646 (86.9)	
Other Government	47 (0.5)	41 (0.6)	*	
Unknown	75 (0.8)	63 (0.9)	12 (0.6)	
No High School Degree				
15.3% +	1,574 (17.4)	1,250 (17.5)	324 (17.1)	
9.1%-15.2%	2,218 (24.6)	1,760 (24.7)	458 (24.2)	
5.0%-9.0%	2,147 (23.8)	1,710 (24.0)	437 (23.1)	0.55
< 5.0%	1,764 (19.5)	1,374 (19.3)	390 (20.6)	
Unknown	1,327 (14.7)	1,041 (14.6)	286 (15.1)	

Ann Surg Oncol. Author manuscript; available in PMC 2024 October 05.

	Overall	pTis	≥pT1	p
Median Income				
< $46,227	1,323 (14.7)	1,067 (15.0)	256 (13.5)	
$46,227-$57,856	1,736 (19.2)	1,374 (19.3)	362 (19.1)	
$57,856-$74,062	1,817 (20.1)	1,451 (20.3)	366 (19.3)	0.16
$74063 +	2,808 (31.1)	2,186 (30.6)	622 (32.8)	
Unknown	1,346 (14.9)	1,057 (14.8)	289 (15.3)	
Institution Type				
Community Cancer Center	635 (7.0)	518 (7.3)	117 (6.2)	
Comprehensive Community Cancer Program	4,163 (46.1)	3,313 (46.4)	850 (44.9)	0.05
Academic/Research Program	2,254 (25.0)	1,740 (24.4)	514 (27.1)	
Integrated Network Cancer Program	1,978 (21.9)	1,564 (21.9)	414 (21.9)	
Estrogen Receptor				
Negative	2,166 (24.0)	1,681 (23.6)	485 (25.6)	
Positive	6,550 (72.5)	5,166 (72.4)	1,384 (73.0)	0.21
Unknown	314 (3.5)	288 (4.0)	26 (1.4)	
Progesterone Receptor				
Negative	3,055 (33.8)	2,337 (32.8)	718 (37.9)	
Positive	5,075 (56.2)	3,941 (55.2)	1,134 (59.8)	0.23
Unknown	900 (10.0)	857 (12.0)	43 (2.3)	
HER2 receptor *				
Negative			1,228 (64.8)	
Positive			359 (18.9)	-
Unknown			308 (16.3)	
Pathologic Tumor Stage				
pT0	30 (0.3)	30 (0.4)		
pTis	7,105 (78.7)	7,105 (99.6)		
pT1	1,724 (19.1)		1,724 (91.0)	-
pT2	136 (1.5)		136 (7.2)	

	Overall	pTis	≥pT1	p
pT3–4	35 (0.4)		35 (1.9)	
Tumor Size (cm)				
Mean ±SD			1.3 ± 5.1	
Median			0.6	
Tumor Grade				
Well differentiated	1,028 (11.4)	606 (8.5)	422 (22.3)	<0.001
Moderately differentiated	3,056 (33.8)	2,242 (31.4)	814 (43.0)	
Poorly differentiated/Undifferentiated	3,822 (42.3)	3,415 (47.9)	407 (21.5)	
Unknown	1,124 (12.5)	872 (12.2)	252 (13.3)	
Lymphovascular Invasion				
Absent	6,872 (76.1)	5,333 (74.7)	1,539 (81.2)	<0.001
Present	134 (1.5)	*	130 (6.9)	
Unknown	2,024 (22.4)	*	226 (11.9)	
Axillary Surgery				
None/biopsy	1,299 (14.4)	1,167 (16.4)	132 (7.0)	<0.001
SLNB alone	5,836 (64.6)	4,543 (63.7)	1,293 (68.2)	
SNLB then ALND	1,052 (11.7)	752 (10.5)	300 (15.8)	
ALND alone	830 (9.2)	662 (9.3)	168 (8.9)	
Unknown	13 (0.1)	11 (0.2)	2 (0.1)	

Note: Table cells show frequency (column percent) or mean ± standard deviation.

*Results suppressed: NCDB does not permit aggregate results for cell sizes < 10

Table 2:

Nodal status of patients undergoing mastectomy for clinical DCIS who underwent surgical nodal staging stratified by pathologic tumor stage.

	Overall	pTis	≥pT1	p
n	7,718	5,957	1,761	<0.001
Number of axillary nodes removed	3.22 ± 3.16	3.01 ± 2.59	3.93 ± 4.50	<0.001
Number of axillary nodes positive	2.23 ± 2.96	2.11 ± 2.85	2.24 ± 2.98	0.86
Pathologic Nodal Stage				
pNX	49 (0.6)	39 (0.7)	10 (0.6)	<0.001
pN0	7,402 (96.2)	5,872 (99.0)	1,530 (86.9)	
pN1	207 (2.7)	17 (0.3)	190 (10.8)	
pN2-3	32 (0.4	*	30 (1.9)	

Note: Table cells show frequency (column percent) or mean ± standard deviation.

*Results suppressed: NCDB does not permit aggregate results for cell sizes <10

Table 3:

Pathologic nodal status of patients undergoing mastectomy for clinical DCIS who upgraded to invasive cancer and underwent axillary surgery stratified by tumor subtype.

	Overall	HR+/HER2−	HER2+	TNBC	p
n	1,472	942	342	188	
Number of axillary nodes removed	4.0 ± 4.7	4.0 ± 4.8	4.2 ± 5.0	3.8 ± 3.7	0.57
Number of axillary nodes positive	2.3 ± 3.0	2.2 ± 3.2	2.1 ± 2.2	3.0 ± 3.9	0.37
Pathologic Tumor Stage					
pT1	1,319 (89.6)	852 (90.5)	304 (88.9)	163 (86.7)	0.13
pT2-4	153 (10.4)	90 (9.5)	38 (11.2)	25 (13.2)	
Pathologic Nodal Stage					
pNX	*	*	*	*	
pN0	1,264 (85.9)	821 (87.2)	283 (82.8)	160 (85.1)	
pN1	173 (11.8)	103 (10.9)	48 (14.0)	22 (11.7)	0.27
pN2	20 (1.4)	10 (1.1)	*	*	
pN3	*	*	*	*	

Note: Table cells show frequency (column percent) or mean ± standard deviation.

*Results suppressed: NCDB does not permit aggregate results for cell sizes < 10

Table 4:

Univariate and multivariable analysis of factors associated with upstage to pN+ among patients with clinical DCIS undergoing mastectomy and axillary surgery who upstage to invasive cancer.

	UNIVARIATE			MULTIVARIABLE		
	OR	*95% CI*	*p*	*OR*	*95% CI*	*p*
Age	0.99	0.96 - 1.02	0.63	0.96	0.92 - 1.00	0.06
Race/Ethnicity						
NH White (ref)						
NH Black	1.87	1.30 - 2.69	<0.001	1.80	1.01 - 3.20	0.05
Hispanic	2.11	1.23 - 3.64	0.01	2.61	1.11 - 6.13	0.03
Asian	0.88	0.48 - 1.62	0.68	0.92	0.38 - 2.25	0.86
Other/Unknown	1.53	0.68 - 3.43	0.30	1.57	0.46 - 5.38	0.47
Charlson/Deyo Score						
0 (ref)						
1	1.17	0.81 - 1.69	0.40	1.19	0.71 - 2.00	0.52
2	1.42	0.83 - 2.40	0.20	0.85	0.38 - 1.92	0.70
≥3	0.83	0.38 - 1.80	0.63	0.35	0.09 - 1.44	0.15
Insurance Status						
Not Insured (ref)						
Private Insurance	0.52	0.11 - 2.47	0.41	0.59	0.08 - 4.68	0.62
Medicaid	0.37	0.06 - 2.25	0.28	0.29	0.02 - 3.45	0.33
Medicare	0.42	0.09 - 1.92	0.26	0.53	0.07 - 3.95	0.54
Other Government	0.23	0.01 - 7.29	0.41	1.03	0.02 - 51.98	0.99
No High School Degree						
15.3% + (ref)						
9.1%-15.2%	0.97	0.64 - 1.47	0.87	1.72	0.91 - 3.24	0.09
5.0%-9.0%	0.70	0.45 - 1.09	0.11	1.39	0.67 - 2.90	0.38
< 5.0%	0.71	0.45 - 1.11	0.13	1.23	0.54 - 2.81	0.63

	UNIVARIATE			MULTIVARIABLE		
	OR	***95% CI***	***p***	***OR***	***95% CI***	***p***
Median Income						
< $46,227 (ref)						
$46,227-$57,856	0.83	0.52 - 1.33	0.43	0.68	0.35 - 1.33	0.26
$57,856-$74,062	0.76	0.47 - 1.22	0.25	0.69	0.34 - 1.38	0.29
$74063 +	0.68	0.44 - 1.05	0.08	0.52	0.25 - 1.07	0.08
Institution Type						
Community Cancer Center (ref)						
Comprehensive Community Cancer Program	1.16	0.62 - 2.17	0.65	0.74	0.31 - 1.73	0.48
Academic/Research Program	1.01	0.52 - 1.94	0.99	0.54	0.22 - 1.34	0.18
Integrated Network Cancer Program	1.22	0.63 - 2.35	0.56	0.91	0.37 - 2.25	0.84
Tumor subtype						
HR+ HER2− (ref)						
HER2+	1.42	1.01 - 2.00	0.05	1.41	0.86 - 2.31	0.17
TNBC	1.15	0.73 - 1.82	0.54	0.96	0.51 - 1.82	0.90
Tumor Grade						
Well differentiated (ref)						
Moderately differentiated	1.95	1.24 - 3.05	0.004	1.84	1.01 - 0.34	0.05
Poorly differentiated/Undifferentiated	3.29	2.06 - 5.26	<0.001	2.87	1.47 - 5.62	<0.001
Lymphovascular Invasion	12.80	8.56 - 19.14	<0.001	12.68	7.56 - 21.27	<0.001

Table 5:

Adjuvant therapy among patients ≥70 undergoing mastectomy for clinical DCIS who upstage to HR+/HER2− invasive cancer stratified by pathologic nodal status.

	pN0	pN+	p
n	1,140	119	
Adjuvant chemotherapy			
Administered	29 (2.5)	24 (20.2)	<0.001
Recommended but not administered	27 (2.4)	10 (8.4)	
Not recommended/administered	1,070 (93.9)	85 (71.4)	
Unknown	14 (1.2)	0 (0.0)	
Adjuvant endocrine therapy			
Administered	686 (60.2)	104 (87.4)	<0.001
Recommended but not administered	112 (9.8)	*	
Not recommended/administered	300 (26.3)	*	
Unknown	42 (3.7)	*	
Adjuvant radiation			
Administered	27 (2.4)	31 (26.1)	<0.001
Recommended but not administered	15 (1.3)	*	
Not recommended/administered	1,079 (94.7)	78 (65.6)	
Unknown	19 (1.7)	*	

Note: Table cells show frequency (column percent) or mean ± standard deviation.

*Results suppressed: NCDB does not permit aggregate results for cell sizes < 10