Factors Associated with Surgical Options for Breast Carcinoma

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BACKGROUND. Breast conservation surgery (BCS) and mastectomy have equivalent survival outcomes for women with breast carcinoma, but treatment decisions are affected by many factors. The current study evaluated the impact of patient and physician factors on surgical decision-making.

METHODS. Statistical analyses were performed on a prospective multicenter study of patients with invasive breast carcinoma. Patient, physician, and geographic factors were considered.

RESULTS. Of 4086 patients, BCS was performed in 2762 (67.6%) and mastectomy was performed in 1324 (32.4%). The median tumor size was 1.5 cm (range, < 0.1–9.0 cm) in patients undergoing BCS and 1.9 cm (range, 0.1–11.0 cm) in patients undergoing mastectomy ($P < 0.00001$). The median age of patients undergoing BCS was 59 years (range, 27–100 yrs), whereas patients who underwent mastectomy were older (median age of 63 yrs, range, 27–96 yrs [$P < 0.00001$]). Physicians in academic practices performed more lumpectomies than those who were not in an academic practice (70.9% vs. 65.7%; $P = 0.001$). More breast conservation procedures were performed by surgeons with a higher percentage of breast practice ($P = 0.012$). Geographic location was found to be significant, with the Northeast having the highest rate of breast conservation (70.8%) and the Southeast having the lowest (63.2%; $P = 0.002$). On multivariate analysis, patient age (odds ratio [OR]: 1.455; 95% confidence interval [95% CI], 1.247–1.699 [$P < 0.001$]), tumor size ($P < 0.001$), tumor palpability (OR: 0.613; 95% CI, 0.524–0.716 [$P < 0.001$]), histologic subtype ($P = 0.018$), tumor location in the breast ($P < 0.001$), physician academic affiliation (OR: 1.193; 95% CI: 1.021–1.393 [$P = 0.026$]), and geographic location ($P = 0.045$) were found to be significant.

CONCLUSIONS. Treatment decisions were found to be related to patient clinicopathologic features, surgeon academic affiliation, and geographic location. Future studies will elucidate the communication and psychosocial factors that may influence patient decision-making. ***Cancer* 2006;106:1462–6.**

KEYWORDS: breast carcinoma, treatment, surgery, lumpectomy, mastectomy.

Over the last several decades, substantial progress has been made in the surgical management of breast carcinoma. The concept of the Halsedian radical mastectomy has yielded to less aggressive surgery; there currently are several surgical options for women with early-stage breast carcinoma, all of which are equivalent in terms of survival.[1,2] However, to our knowledge, the factors involved in this decision-making process between breast conservation therapy (lumpectomy and radiation therapy) and mastectomy are still unclear. Whereas this decision is often the patient's individual choice, taking into consideration clinicopathologic variables such as tumor

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size, to our knowledge the influence of physician factors have been understudied in the literature.

The objective of the current study was to evaluate the impact of various clinicopathologic variables, as well as geographic and physician factors, on surgical decision-making in women with breast carcinoma. We examined the choice of breast conservation surgery (BCS) versus mastectomy in a cohort of more than 4000 patients in the University of Louisville Sentinel Lymph Node Study to determine factors that influence surgical decision-making.

MATERIALS AND METHODS

The University of Louisville Breast Sentinel Lymph Node Study is a multiinstitutional prospective study in which more than 300 general surgeons from both private and academic practices participated. This study was approved by the institutional review board at each site and all patients who participated in the study provided informed consent.

Patients with clinical T1–2, N0 breast carcinoma were eligible for this study. Patients consented to sentinel lymph node biopsy followed by completion axillary lymph node dissection. The decision to undergo BCS versus mastectomy was left to the discretion of the patient and her surgeon. Between May 7, 1998, to August 2, 2004, a total of 4131 patients were enrolled. Of these, the type of surgery (BCS or mastectomy) was recorded for 4086 patients (98.9%). This formed the cohort of interest for this retrospective analysis of prospectively collected data. Data regarding patient demographics, clinicopathologic variables, and geographic and community factors, as well as surgeon characteristics, were collected in a prospective fashion.

Statistical analyses were performed using SPSS software (version 11.0; SPSS Inc., Chicago, IL) using likelihood ratio tests for univariate comparisons of discrete variables and binary logistic regression for multivariate analyses. Significance was set at $P = 0.05$.

RESULTS

As shown in Table 1, the patients in the current study were treated by a heterogeneous group of surgeons from a wide array of communities, broadly mirroring breast surgical practice in the U.S. The clinicopathologic features of the overall patient population in this study are shown in Table 2. The median patient age in the current study was 54 years (range, 27–100 yrs). The median tumor size was 1.5 cm (range, 0.1–11.0 cm). The majority of patients had early-stage disease, with only 2.7% having tumors that were found to be greater than 5 cm in maximum dimension on pathological analysis.

TABLE 1
Surgeon and Community Characteristics

Characteristic	No. of cases (%)
Breast surgery experience (no. cases/year)[a]	
0–10 cases	233 (5.6)
11–30 cases	1825 (44.2)
> 30 cases	1946 (47.1)
Percentage of practice breast-related[b]	
0–10%	815 (19.7)
11–50%	2758 (66.8)
>50%	453 (11.0)
Academic affiliation[c]	
Yes	1476 (35.7)
No	2548 (61.7)
Community size[d]	
≤ 100,000	1778 (43.0)
>100,000–500, 000	1450 (35.1)
> 500, 000	867 (21.0)
U.S. region	
Midwest	1275 (30.9)
Northeast	1000 (24.2)
Southeast	1148 (27.8)
West	708 (17.1)

[a] Breast surgery experience not specified in 126 cases (3.1%).
[b] Percent of breast-related practice not specified in 105 cases (2.6%).
[c] Academic affiliation not specified in 107 cases (2.6%).
[d] Community size not specified in 36 cases (0.9%).

TABLE 2
Clinicopathologic Variables

Characteristic	No. of cases (%)
Tumor size[a]	
≤ 2 cm	2471 (59.8)
> 2–5 cm	1377 (33.3)
> 5 cm	113 (2.7)
Palpable primary tumor	
Yes	1953 (47.3)
No	2178 (52.7)
Histologic subtype	
Ductal	3399 (82.3)
Lobular	348 (8.4)
Other	384 (9.3)
Location[b]	
Upper outer quadrant	2089 (50.6)
Upper inner quadrant	588 (14.2)
Lower inner quadrant	322 (7.8)
Lower outer quadrant	464 (11.2)
Central	589 (14.3)

[a] Tumor size not specified in 165 cases (4.0%).
[b] Location not specified in 78 cases (1.9%).

In this cohort of patients, 2762 (67.6%) underwent BCS and 1324 (32.4%) underwent a mastectomy. Univariate analyses were performed to examine which clinicopathologic features influenced the decision between BCS and mastectomy (Table 3). All the clinico-

TABLE 3
Clinicopathologic Variables versus Type of Surgery

Characteristic	No. of cases (%)		Significance
	Breast conservation	Mastectomy	
Patient age[a]			$P = 0.001$
< 55 yrs	1038 (70.7)	430 (29.3)	
≥ 55 yrs	1688 (65.6)	884 (34.4)	
Tumor size[b]			$P < 0.001$
≤ 2 cm	2027 (73.2)	744 (26.8)	
> 2-5 cm	602 (56.2)	469 (43.8)	
> 5 cm	32 (40.5)	47 (59.5)	
Palpable primary tumor			$P < 0.001$
Yes	1329 (61.6)	828 (38.4)	
No	1433 (74.3)	496 (25.7)	
Histologic subtype			$P < 0.001$
Ductal	2315 (68.9)	1047 (31.1)	
Lobular	196 (56.6)	150 (43.4)	
Other	251 (66.4)	127 (33.6)	
Location[c]			$P < 0.001$
Upper outer quadrant	1434 (69.4)	631 (30.6)	
Upper inner quadrant	414 (71.4)	166 (28.6)	
Lower inner quadrant	210 (66.9)	104 (33.1)	
Lower outer quadrant	414 (71.4)	142 (30.7)	
Central	338 (57.7)	248 (42.3)	

[a] Patient age not specified in 46 cases (1.1%).
[b] Tumor size not specified in 165 cases (4.0%).
[c] Location not specified in 78 cases (1.9%).

TABLE 4
Surgeon and Community Characteristics versus Type of Surgery

Characteristic	No. of cases (%)		Significance
	Breast conservation	Mastectomy	
Breast surgery experience (no. cases/ year)[a]			$P = 0.236$
0–10 cases	150 (64.4)	83 (35.6)	
11–30 cases	1196 (66.4)	605 (33.6)	
> 30 cases	1320 (68.5)	606 (31.5)	
Percentage of practice breast-related[b]			$P = 0.012$
0–10%	513 (63.7)	292 (36.3)	
11–50%	1875 (68.7)	853 (31.3)	
>50%	317 (70.8)	131 (29.2)	
Academic affiliation[c]			$P = 0.001$
Yes	1036 (70.9)	425 (29.1)	
No	1655 (65.7)	863 (34.3)	
Community size[d]			$P = 0.131$
≤ 100,000	1175 (67.0)	578 (33.0)	
>100,000–500, 000	960 (67.0)	473 (33.0)	
> 500, 000	610 (70.6)	254 (29.4)	
U.S. region			$P = 0.002$
Midwest	869 (68.8)	395 (31.3)	
Northeast	700 (70.8)	289 (29.2)	
Southeast	715 (63.2)	416 (36.8)	
West	478 (68.1)	224 (31.9)	

[a] Breast surgery experience not specified in 126 cases (3.1%).
[b] Percentage of breast-related practice not specified in 105 cases (2.6%).
[c] Academic affiliation not specified in 107 cases (2.6%).
[d] Community size not specified in 36 cases (0.9%).

TABLE 5
Multivariate Analysis

Characteristic	OR (95% CI)	Significance
Age < 55 yrs	1.455 (1.247–1.699)	$P < 0.001$
Tumor size[a]		$P < 0.001$
Tumor palpability	0.613 (0.524–0.716)	$P < 0.001$
Histologic subtype[a]		$P = 0.008$
Tumor location[a]		$P < 0.001$
Academic affiliation	1.193 (1.021–1.393)	$P = 0.026$
U.S. region[a]		$P = 0.045$

OR: odds ratio; 95% CI: 95% confidence interval.
[a] Odds ratios not available due to multiple comparisons.

pathologic variables analyzed were found to be significantly associated with the type of surgery. In addition, we examined the influence of geographic factors and surgeon characteristics on surgical decision-making (Table 4). Whereas the number of breast surgery cases surgeons performed in the last year was not found to have a significant impact on the type of surgery performed, surgeons who had a higher percentage of their practice that was breast-related and those who were affiliated with academic centers were more likely to perform breast conservation procedures. Academic affiliation did not necessitate fellowship training in surgical oncology or breast surgery, but rather simply being part of a faculty at an institution of higher learning. In addition, whereas the population of the community did not make a significant difference in terms of the type of surgeries performed, a marked difference was noted according to geographic region.

A multivariate analysis was then performed to determine which clinicopathologic, geographic, surgeon, and community factors were independently related to surgical treatment type (Table 5). This demonstrated that all of the factors that were found to be significant on univariate analyses remained significant in the multivariate model, with the exception of percentage of breast-related practice. Therefore, not only the clinicopathologic variables of age, tumor size, palpability, histologic subtype, and tumor location were associated with the type of surgical procedure, but also the surgeon's academic affiliation and the geographic location of the community in the U.S.

DISCUSSION

With data demonstrating the equivalence of BCS and mastectomy in terms of survival for women with breast carcinoma,[1,2] many clinicians have believed

that breast conservation should be the technique of choice for surgical removal of Stages I and II invasive breast carcinomas.[3,4] However, there are many factors that influence this decision, and ultimately this is a woman's choice in consultation with her physician.

In the current study, we found that a number of patient and tumor factors had a significant impact on the decision between treatment with BCS versus mastectomy. To begin with, patient age was an independent predictor of type of surgery. This is in agreement with a number of other studies that have found that older patients tended to undergo mastectomy as opposed to BCS.[5–8] Some have found the opposite, with the highest rate of breast conservation therapy being noted in octogenarians,[9] and still others have concluded that age was not significantly different between patients who choose BCS versus those who choose mastectomy.[10] Although one of the limitations of the current study was the fact that it could not pinpoint the reason why age featured prominently in this decision, some have hypothesized that older patients are less concerned with cosmetic outcome and therefore may more often opt for mastectomy.[7,11] In addition, older patients may wish to avoid the inconvenience of 6 weeks of daily radiation therapy and therefore may choose mastectomy over BCS and radiation. Several studies have found that older patients undergoing BCS may not receive radiation therapy as adjuvant treatment.[6,12,13] Whereas this policy has traditionally fallen outside of clinical guidelines, the local recurrence rate after BCS decreases with age, causing some to question the need for adjuvant radiation therapy in the elderly.[14] A recent study suggested that in a subset of patients age 70 years or older, with T1 lymph node-negative, estrogen receptor-positive breast carcinoma, the addition of radiation therapy may not offer a significant advantage over adjuvant therapy with tamoxifen alone.[15] However, this study had a short follow-up and other studies with more liberal inclusion criteria have found that radiation does provide significantly improved local control in patients undergoing breast conservation.[1,2,16] Advances in accelerated partial breast irradiation that would limit the duration of radiation therapy to 5 days are currently the subject of ongoing national clinical trials; the impact of such techniques on surgical decision-making in older patients remains to be investigated.

Several tumor characteristics were found to be independent predictors of surgical therapy in the current study. Tumor size and palpability were found to be associated significantly with surgery type with larger, more palpable tumors often being associated with mastectomy. This may be related to a larger tumor-to-breast ratio, which may be an indication for mastectomy.[3,4] Lobular histology also was found to be correlated with a higher rate of mastectomy. It has been well established that lobular histology is often associated with positive surgical margins,[17,18] and therefore this may have potentially led to a higher mastectomy rate. In a study of 182 patients with infiltrating lobular carcinoma, Molland et al.[19] found that although similar numbers of patients opted for initial BCS and mastectomy, the final number of patients requiring mastectomy for positive surgical margins was significantly higher. However, breast conservation is an accepted alternative for patients with invasive lobular tumors if clean margins can be achieved, and therefore histologic subtype alone would not have been thought to be an independent predictor of surgical management decisions.[4] Similarly, central tumor location also was found to be associated with mastectomy, even though this is no longer considered a contraindication for breast conservation.[4] Some may argue, however, that patients wishing to avoid a 'volcano defect' may opt for mastectomy in this circumstance.

A number of studies have established that the surgeon's judgment and opinion are critical in making the decision of surgical treatment for breast carcinoma. However, to our knowledge, few studies to date have studied the practice patterns of surgeons as a determinant of surgical type. The current study examined the practice of a wide array of surgeons from diversified practices from around North America, and therefore should be reasonably reflective of surgical practice in general. However, the surgeons participating in the current study were participating in a study introducing the technique of sentinel lymph node biopsy. Therefore, it is possible that these surgeons may be more 'minimally invasive' in their perspective. Surgeons who had a larger percentage of their practice associated with breast carcinoma were more likely to perform breast conservation. Whereas this factor was significant on univariate analysis, it did not remain so in the multivariate model. Therefore, the percentage of breast practice was not an *independent* predictor of type of surgery. However, academic affiliation was found to be associated with a higher rate of breast conservation, regardless of tumor factors. It is not clear why academic surgeons were more likely to perform breast conservation procedures, although certainly the availability of radiation therapy may explain part of this trend. However, the results of the study by Nattinger et al.[20] suggest that although the availability of radiation services certainly impacted the rate of breast conservation, medical school affiliation also was found to be a significant factor in their study.

Similar to other reports, we also found that geographic factors impacted surgical decision-making for

women with breast carcinoma.[20] The Northeast has the highest rate of breast conservation *independent* of patient age, tumor factors, and surgeon practice. The cause of this geographic pattern (whether related to the psychologic, educational, or social composition of the population; the attitudes of the physicians in that region; proximity to radiation therapy facilities; or other factors) remains unclear. In addition, whereas we found that the size of the community did not affect surgical decision-making, we do not have data regarding proximity to a major city. This may impact decision-making in terms of making radiation therapy more accessible.

Although the current study suffered from the inability to directly question patients and their surgeons regarding factors influencing their decision-making, to our knowledge it is one of the largest studies published to date that has elucidated factors concerning multivariate analysis related to surgical decision-making in patients with breast carcinoma. Further work is clearly indicated to explore those factors affecting patient decision-making, including communication between the physician and patient, and to develop decision aids that may assist in this process.

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