Mastectomy or Breast-Conserving Therapy: Which Factors Influence A Patient's Decision?

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ABSTRACT

Background: The choice between mastectomy and breast-conserving therapy (BCT) is a first step for patients with breast cancer who are confronting decisions about treatment.

Objective: To identify the most important determinants in treatment decision making by patients with breast cancer.

Methods: Between 2003 and 2013, a total of 5258 patients with breast cancer were recorded in Kaiser Permanente Northwest's cancer registry. Patients had similar clinical-pathologic profiles, education, and insurance coverage, and were managed by 1 surgical group. A total of 2604 patients with invasive breast cancer chose mastectomy or BCT as they met unambiguous criteria for equivalent outcomes with either option. We examined the influence of the patient's surgeon on patient preferences.

Results: Our retrospective analyses examined a study population that had similar risk profiles (age, family history of breast cancer, T category on tumor-node-metastasis staging system, tumor size, physical examination findings), surgeons consulting on similar patient types, and managed by surgeons with similar surgical performance patterns (case volumes, reexcision rates, number of reoperations, and ability to meet patient's expectations). Patients who preferred mastectomy were strongly influenced by tumor size ($p < 0.001$) and abnormal physical examination findings (palpable mass; $p = 0.004$), rather than age, family history of breast cancer, T category, or surgeon.

Conclusion: Physical examination findings and tumor size were statistically significant determinants influencing patients to choose mastectomy. Because geographic and practice style explanations fail to explain these variations, surgeons can identify, anticipate, and consider these factors when counseling patients about mastectomy and BCT therapeutic equivalency.

INTRODUCTION

Patients with breast cancer are presented and must understand complicated information about the disease and treatment choices before deciding on treatment. Mastectomy continued to be the most common breast cancer surgical operation performed up to and during the 1980s, even though early results of a randomized controlled trial comparing radical mastectomy surgery and breast-conserving therapy (BCT; ie, lumpectomy, lymph node dissection, and radiotherapy) in 1977 showed that recurrence and survival rates were comparable.[1] With the introduction of mammographic screening (1960s),[2] breast ultrasonography (1980s),[3] and magnetic resonance imaging (1990s),[4-6] the size of breast cancers detected decreased. Advances in tissue biopsy (core biopsy, needle localization,[7] and fine-needle aspiration[8,9]) as well as tissue handling (staining, marking, sectioning, imprints, and specimen radiography) and pathologic interpretation contributed to the shift to BCT over mastectomy. The transition from a 2-stage to 1-stage BCT procedure also influenced patients. By 1990 the National Cancer Institute reported follow-up results, measured by patients' local recurrence and survival rates for tumor-node-metastasis (TNM) staging (T1N0, T2N0, T3N0),[10,11] which confirmed that mastectomy and BCT were therapeutically equivalent.

The transition from the Halsted concept that breast cancer was a localized disease to our current understanding that it is a systemic disease was difficult for the public, patients, and many surgeons.[12,13] Although estimates that three-fourths of patients with invasive breast cancer are candidates for BCT, rates of BCT varied nationally.[14] With the controversy about the surgical mastectomy and BCT equivalency over, it was unclear why substantial national geographic variations persisted as rates of mastectomy and prophylactic mastectomy increased. We therefore sought to examine the surgeon's influence on patient choice of treatment of breast cancer.[15] Was the patient preference predicated on her personal risk profile or by her surgeon? Did surgeon-specific performance (BCT and reexcision rates, secondary reexcision strategies, and case volumes) influence the patient decision making?[16-18] We studied a series of patients with similar risk profiles in 1 health care entity using measurable standardized processes to assess the influence of age, family history of breast cancer, T category, tumor size, physical examination (PE) findings, and the surgeon on treatment choices.

METHODS

Information on all patients with breast cancer (2003-2013) was drawn from the Kaiser Permanente Northwest (KPNW) cancer registry,[19] electronic medical record, and pathologic and imaging reports. The study included patients with invasive breast cancer (Table 1) who met study criteria in which there was an outcome universally considered equivalent for either a mastectomy or BCT. Certain patient, tumor pathology, and treatment factors were excluded from the study to ensure we compared a uniform set of patients. The excluded patient factors were men, women younger than age 30 years or older than age

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89 years, those with a personal history of prior breast cancer, and those with a *BRCA* gene mutation or family history of *BRCA* mutation. The pathologic factors excluded were lobular carcinoma in situ, intraductal carcinoma, and anomalous pathologies (clear-cell, giant-cell, non-small cell, and signet-ring cell carcinomas; inflammatory breast cancer; melanoma; Paget disease of the nipple; phyllodes tumors; sarcoma; squamous cell breast cancers), TNM stage 4 tumors (> 70 mm),[20] and multicentric and bilateral breast cancers. Patients who refused treatment, had neoadjuvant therapy, underwent mantle-field or chest radiation therapy, or had a history of breast reduction or augmentation were excluded.

All the preoperative counseling was performed by 38 board-certified surgeons. Although all new cancers were reviewed by regional tumor boards, case discussions focused on cases of general interest, complexity, rarity, or close or positive margins, or at the request of clinicians. Surgeons usually recommended reexcision for close margins because margins less than 5 mm were inadequate and too close because of the risk of local recurrence, although consensus guidelines about the adequacy of margins have evolved during the study period. To assess the surgeon's influence on patient preferences, we extracted surgeon-specific performance metrics from the registry database. Surgeon profiles included documentation of successful mastectomy (no tumor on margin) or lumpectomy (margins > 1-2 mm); number of BCT operations (1-4 reoperations); reexcision cascade (unsuccessful lumpectomy, reexcision, second or third unsuccessful reexcisions, and follow-up mastectomy or bilateral mastectomy); percentage of patients who were successfully managed to their BCT preference; and data successful mastectomy, or bilateral mastectomy (contralateral prophylactic) rates. There were 13 surgeons in continuous practice during the whole study period who were defined as high-volume (75-169 patients). The remaining 25 low-volume (12-74 patients) had discontinuous breast cancer practices as subspecialists, retirees, and new hires.

JASP Version 0.8.5 software (University of Amsterdam, Amsterdam, The Netherlands) was used for statistical analyses of linear and logistic regression, analysis of variance (ANOVA), and χ^2 tests.

Table 1. Profile of the 2604 study patients

Characteristic	No. (%)
Age, y	
30-39	83 (3)
40-49	369 (14)
50-59	713 (27)
60-69	800 (31)
70-79	436 (17)
80-89	203 (8)
TNM T category[20]	
T1mic: (< 1 mm)	66 (3)
T1A: (> 1 mm to ≤ 5 mm)	186 (7)
T1B: (> 5 mm to ≤ 10 mm)	527 (20)
T1C: (> 10 mm to ≤ 20 mm)	1126 (43)
T2: (> 20 mm to ≤ 50 mm)	685 (26)
T3: (> 50 mm)	14 (1)
Family history of breast cancer	
Yes	1057 (41)
No	1547 (59)
Physical examination finding (mass)	
Yes	1243 (48)
No	1345 (52)
Unknown	16 (< 1)
Patient preference	
Breast-conserving therapy	2039 (78)
Mastectomy	565 (22)

TNM = tumor-node-metastasis.

RESULTS

Historical Performance

The overall KPNW BCT rates for all patients with breast cancer, increased from 28% (1980-1989), to 50% (1990-1999), and then to 61% (2000-2009). The overall KPNW BCT preference rate for the study's patients was 78% (2003-2013). Using the same exclusionary criteria that defined our study population, we determined that KPNW's local recurrence rates for mastectomy and BCT local recurrence rates were similar (1990-1999 operative cohort: Mastectomy, 1.8%; BCT, 3.1%; 2000-2009 operative cohort: Mastectomy, 1.0%; BCT, 1.9%; 2010-2013 operative cohort: Mastectomy, 0.4%; BCT, 0.4%), demonstrating a statistically significant ($p < 0.0001$ by χ^2 test) decline between 1990 and 2013. Of note, the local recurrence rates for mastectomy and BCT were remarkably lower than the 10% rate reported decades earlier.[21,22]

Patient Profiles

All 2604 study patients had invasive breast cancer; were insured in the same prepaid health maintenance organization (HMO); were provided a similar preoperative educational experience; counseled by members of 1 surgical group; met the same selection criteria (sex, age, pathology, PE findings, and family history; Table 1); and offered equivalent treatment choices of either mastectomy or BCT. A linear regression analysis was employed to see if there was a change in any variable during the study period, including age, family history of breast cancer, PE findings, tumor size, T category, and patient preference for surgical therapy (Table 2). As shown in Table 3, ANOVA was used to see if patient characteristics varied across surgeons. There was no finding of significance for any of the variables, meaning the different surgeons saw a similar population of patients.

Surgeon Performance

In examining surgeon-specific performance (case volumes, reexcision rates, and success rates of achieving initial patient preferences), there was no evidence that

Table 2. Linear regression of year vs patient variables during the 2003-2013 study period showing no significant change over time

Model	Patient variable	Unstandardized	SE	Standardized	*t*	p value
1	(Intercept)	2007.895	0.454		4422.064	< 0.001
	Age	-9.689	0.005	-0.004	-0.187	0.852
	Family history	-0.034	0.125	-0.005	-0.273	0.785
	PE finding	0.086	0.137	0.014	0.626	0.532
	Tumor size	0.010	0.010	0.034	1.005	0.315
	T category	-0.008	0.104	-0.003	-0.082	0.935
	Patient preference	0.011	0.153	0.001	0.069	0.945

PE = physical examination; SE = standard error.

Table 3. ANOVA test of surgeons vs patient variables showing no significant difference in patient characteristics between surgeons

Patient variable	Sum of squares[a]	*df*	Mean square	*F*	p value
Stage	923.702	5	184.740	1.539	0.174
PE finding	255.809	1	255.809	2.131	0.144
Age	5789.444	59	98.126	0.818	0.838
Family history	2.777	1	2.777	0.023	0.879
Patient preference	20.827	1	20.827	0.174	0.677
Tumor size	6992.241	62	112.778	0.940	0.611
Residual disease	296,920.868	2474	120.017		

[a] Type II sum of squares.
ANOVA = analysis of variance; df = degrees of freedom; PE = physical examination.

surgeon performance influenced patient preference. The ratio of total number of surgeries required to satisfy the patient's preference (2016/1530) was similar for the 13 highest-volume surgeons (1.32 ± 0.05, not significant). Achieving BCT success varied by tumor size, with the greater difficulty occurring with the smallest (< 5 mm) and largest tumors (> 50 mm to < 71 mm; Figure 1). Most surgeons recommended a reexcision for positive or close margins (> 1 mm to < 10 mm), consistent with tumor board recommendations. The reoperative rates for close or positive margins was similar for both palpable and nonpalpable lesions (Figure 2). We observed no significant variation in the reoperative patterns during the study period (Figure 3). The 8 reoperative strategies included reexcision, mastectomy, or bilateral mastectomy. From 2003 to 2013, BCT, as the first procedure, was successful 63% of the time. Seventy-eight percent of patients preferred the BCT strategy.

Decision-making Determinants

Patient preference (for mastectomy or BCT) vs other patient characteristics was analyzed with logistic regression to see which, if any, factors were related to preference (Table 4). Tumor size and palpability (size and PE findings) were significantly related to patient preference (Figure 4). The surgeon was not related to patient choice, nor was family history, age, or cancer stage. Preoperative palpable findings usually correlated with tumor size and T category, although we noted that some larger tumors had no PE findings and abnormal PE findings were described for some small tumors. The absence of an association of BCT preference with size and not T category may be explained by how T category is defined by using a size range, thus reducing the importance of tumor size measurements. The association between PE findings and tumor size and patient preference over a long study time period have been consistent, as have the reoperative strategies supporting patient's initial preferences.

DISCUSSION

As increasing and ever-changing treatment options for patients with breast cancer have made decision making more complex, surgeons are expected to meet patient expectations. In our review of the last 3 decades at KPNW, more than 50% of the breast cancers were diagnosed preclinically (no palpable mass),[23] BCT rates slowly increased,[24] patient preference for BCT was frequently met at the same rate over time, and there was a decline in the rates of reexcision and local recurrence. We believe these achievements are a consequence of increased mammography screening, standardization of patient educational materials, multidisciplinary care coordination, and improvements in surgical performance.

Even though there has been universal acceptance of BCT and mastectomy equivalency for most new patients with breast cancer, BCT national rates have

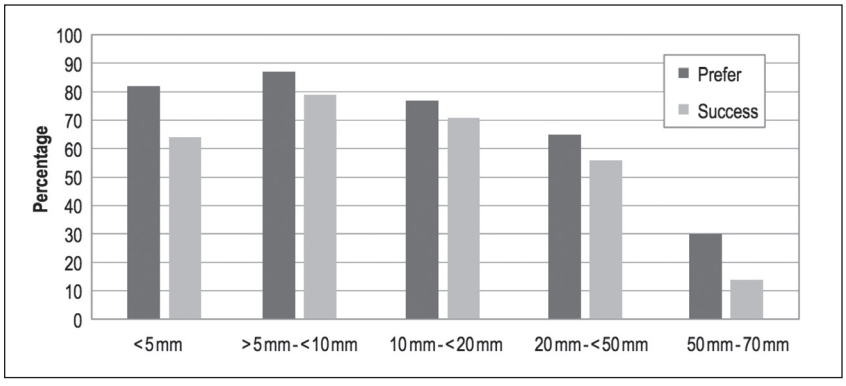

Figure 1. Success of breast-conserving therapy (BCT) for patients who preferred BCT, by tumor size, 2003-2013.

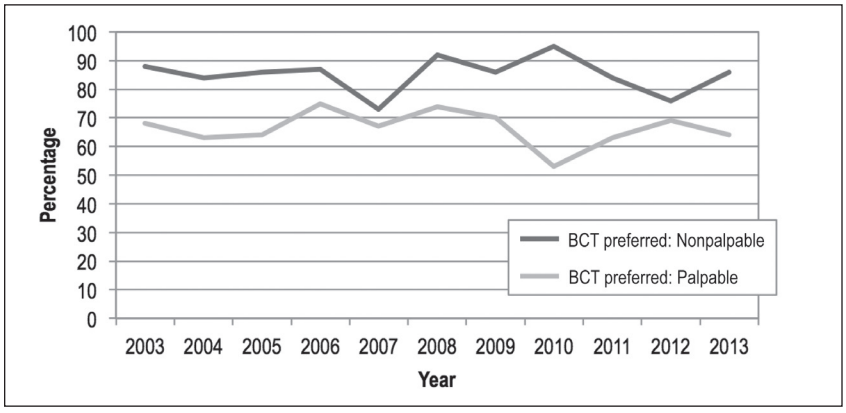

Figure 2. Comparison of breast-conserving therapy (BCT) preference rates with physical examination findings (palpable tumor), 2003-2013.

plateaued or declined in some geographic and practice settings since 1998.[24,25] These trends stimulated the question: Why, when three-fourths of women are BCT candidates, are fewer patients choosing BCT? Authors have attributed this phenomenon to numerous possible factors. They include evolution of roles in the informed consent process and inadequacy of patient educational materials, insurance coverage, access to care and treatment facilities, radiation therapy, length of treatments, travel time for treatment and work loss, marital status, a woman's sexuality and body image, education, socioeconomic status, race, surgeon's sex, primary counseling by resident trainees and lack of face-to-face time with the surgeon, previous cancer surgery, increased preoperative use of magnetic resonance imaging,[25] and anxiety and fear.[12,18] This investigation, focusing on a large equal-risk population managed by 1 surgical group, assessed the influence of common metrics for tumors and surgical performance.

Patients, physicians, and surgeons were contending with the shift from the "physician-as-expert" decision-making process to a patient-centered approach.[26] This was awkward, time-consuming, and a challenge for many clinicians. Increasingly, patients came to their surgeon having "researched" their options from friends, pamphlets, breast cancer calculators, and information from the Internet.[27-31] Although some patients appeared prepared, many were unable to recall basic information.[32] Recognizing this, clinicians encouraged patients to bring partners, family members, and friends to the visit because the process is overwhelming.[31,33] By providing standardized breast cancer treatment information packets and access to computer information, we were better able to assess the influence of the surgeon on the patient's decision making.

Our study reviewed the preferences of patients with invasive breast cancer who were excellent candidates for either mastectomy or BCT (Table 1), excluding patients in whom decision making was more complicated. KPNW provided expert care at low out-of-pocket cost to patients with breast cancer with access to multiple specialists (plastic surgeons, second opinions, genetics and cancer counselors, support groups, and recently navigators for patients with breast cancer) and had a standard informed consent process. Patients were insured by the same insurer, were provided with standardized preoperative education tools, and had similar personal risk profiles (age, pathology, tumor size, T category, family history of breast cancer, and PE findings).

We studied whether and how patient-specific variables of age, T category, tumor size, PE palpable findings, family history of breast cancer, and the surgeon influenced a patient's decision for mastectomy or BCT. The discovery of a palpable mass by self-examination, during mammography, or on clinical examination is a statistically significant factor in a patient's choice of mastectomy, despite evidence that a BCT strategy provided equivalent outcomes. Tumor size was also an influential factor leading women to favor mastectomy. These 2 variables standout as predictors of distress. Because tumor size and PE findings are available to surgeons, surgeons should acknowledge their influence on BCT decision making and can tailor discussions to allay fears. Patients must be clear about common misconceptions about breast cancer and treatments. Reported rates of reexcision, ipsilateral breast tumor recurrence, lifetime risk of contralateral breast

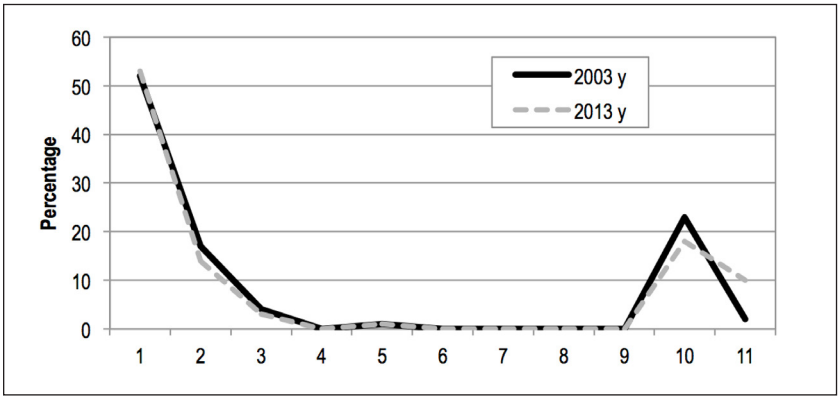

Figure 3. Patients' surgical preference cascade for breast-conserving therapy, 2003-2013. Numbers on x-axis indicate the following: 1 = lumpectomy; 2 = lumpectomy, then reexcision; 3 = lumpectomy, then reexcision, then unilateral mastectomy; 4 = lumpectomy, then reexcision, then bilateral mastectomy; 5 = lumpectomy, then 2 separate reexcisions, then unilateral mastectomy; 6 = lumpectomy, then 3 reexcisions, then unilateral mastectomy; 7 = lumpectomy, then 3 reexcisions; 8 = lumpectomy, then 3 reexcisions, then unilateral mastectomy; 9 = lumpectomy, then 3 reexcisions, then bilateral mastectomy; 10 = unilateral mastectomy; 11 = bilateral mastectomy.

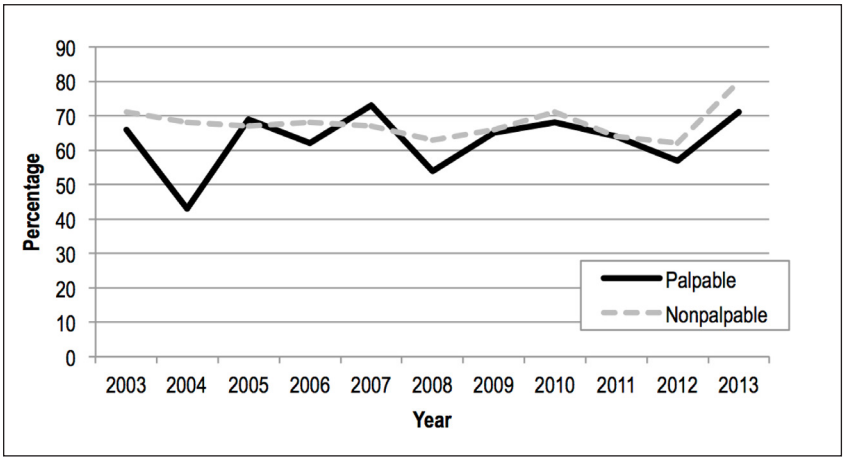

Figure 4. Comparison of breast-conserving therapy success rates with physical examination findings, 2003-2013.

Table 4. Logistic regression of patient preference (mastectomy or breast-conserving therapy) vs patient variables showing that size and palpability of tumor significantly influence choice

Patient variable	Estimate	SE	p	95% Confidence limits	
				Lower boundary	Upper boundary
(Intercept)	-1.424	0.373	< 0.001	-2.156	-0.692
Size	0.046	0.007	< 0.001	0.033	0.060
PE finding	-0.315	0.109	0.004	-0.529	-0.101
Stage	-0.125	0.082	0.129	-0.286	0.036
Age	-0.001	0.004	0.737	-0.009	0.007
Family history	0.078	0.100	0.439	-0.119	0.275
Surgeon	-0.002	0.004	0.691	-0.011	0.007

PE = physical examination; SE = standard error.

cancer, and rate of breast deformity from radiation therapy are sometimes overreported.[34] It is important when patients are researching information that they are clear about the ability for resection in the event of ipsilateral breast tumor recurrence, imaging surveillance of both breasts, and cosmetic results from various options. The most recent consensus on acceptable tumor margins, similar to criteria used more than 3 decades earlier, will expectedly lead to a decrease in reexcisions after lumpectomy.[35-37]

We acknowledge the limitations of this retrospective study. In particular, we have not examined other variables reported in other studies such as socioeconomic status, psychosocial support, patient satisfaction, race, age, or surgeon's sex. Our review is unique because many of the confounding variables of other reports were not controlled as in our study, such as standardized care paths, care with an integrated multispecialty group practice with HMO insurance coverage in a community setting. This study provides a practical approach to allay predictable triggers to anxiety and fear as patients consider their surgical options.

CONCLUSION

Patients with breast cancer must manage the anxiety and fears of their new diagnosis and must search for their best treatment options. Physicians and other health support systems can provide information and expertise as patients consider their next steps. We assume that patients consider the information and data we provide, although they may be making their decisions through the lens of anxiety and fear. We examined the influence of age, family history of breast cancer, TNM T category, tumor size, PE findings, and surgeon experience to understand whether any of these factors play a significant role when patients decide between a mastectomy and BCT. We identified tumor size and the presence of PE findings as the most significant contributors to a mastectomy choice. By recognizing these risk factors, surgeons can anticipate and then explicitly address these factors as they partner with their patients. If surgeons consider these known factors as they begin counseling patients about mastectomy and BCT equivalency, the rates of BCT may increase, reducing unexplained geographic and practice variations.

"Doctors search for supportive signs in the medical laboratories to develop a therapeutic attack plan, while I searched through my memory and psyche."

— Entry from the diary of a patient with breast cancer, 1979

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Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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