

Understanding the Impact of Breast Reconstruction on the Surgical Decision-Making Process for Breast Cancer

Amy K. Alderman, MD, MPH^{1,2}

Sarah T. Hawley, PhD^{2,3}

Jennifer Waljee, MD⁴

Mahasin Mujahid, PhD⁵

Monica Morrow, MD⁶

Steven J. Katz, MD, MPH^{2,3}

¹ Section of Plastic Surgery, Department of Surgery, University of Michigan Medical Center, Ann Arbor, Michigan.

² Veterans Administration Center for Practice Management and Outcomes Research, Ann Arbor VA Health Care System, Ann Arbor, Michigan.

³ Division of General Medicine, Department of Internal Medicine, University of Michigan Medical Center, Ann Arbor, Michigan.

⁴ Robert Wood Johnson Clinical Scholars Program and the Department of Surgery, University of Michigan Medical Center, Ann Arbor, Michigan.

⁵ Department of Epidemiology, University of Michigan School of Public Health, Ann Arbor, Michigan.

⁶ Department of Surgical Oncology, Fox Chase Cancer Center, Philadelphia, Pennsylvania.

This work was funded by a grant from the National Cancer Institute (R01 CA8837-A1) to the University of Michigan. This project has been funded in part with federal funds from the National Cancer Institute, National Institutes of Health, Department of Health and Human Services, under Contract No. N01-PC-35139 and N01-PC-65064.

The collection of cancer incidence data used in this publication was supported by the California Department of Health Services as part of the statewide cancer reporting program mandated by California Health and Safety Code Section 103885.

The ideas and opinions expressed herein are those of the author, and no endorsement by the State of California, Department of Health Services is intended or should be inferred.

BACKGROUND. Reconstruction is rarely incorporated into the decision-making process for surgical breast cancer treatment. We examined the importance of knowing about reconstruction to patients' surgical decision-making for breast cancer.

METHODS. We surveyed women aged ≤ 79 years with breast cancer ($N = 1844$) who were reported to the Detroit and Los Angeles Surveillance, Epidemiology, and End Results (SEER) cancer registries (response rate, 77.4%). The dependent variables were 1) patients' report of having a discussion about breast reconstruction with their general surgeon (yes/no), 2) whether or not this discussion had an impact on their willingness to be treated with a mastectomy (yes/no), and 3) whether the patient received a mastectomy (yes/no). The independent variables included age, race, education, tumor size, tumor behavior, and presence of comorbidities. Chi-square, Student *t* test, and logistic regression were used for analyses.

RESULTS. Only 33% of patients had a general surgeon discuss breast reconstruction with them during the surgical decision-making process for their cancer. Surgeons were significantly more likely to have this discussion with younger, more educated patients with larger tumors. Knowing about reconstructive options significantly increased patients' willingness to consider a mastectomy (OR, 2.06; $P < .01$). In addition, this discussion influenced surgical treatment. Patients who discussed reconstruction with their general surgeon were 4 times more likely to receive a mastectomy compared with those who did not (OR, 4.48; $P < .01$).

CONCLUSIONS. Most general surgeons do not discuss reconstruction with their breast cancer patients before surgical treatment. When it occurs, this discussion significantly impacts women's treatment choice, making many more likely to choose mastectomy. This highlights the importance of multidisciplinary care models to facilitate an informed surgical treatment decision-making process.

Cancer 2008;112:489-94. © 2007 American Cancer Society.

KEYWORDS: breast reconstruction, breast cancer, SEER, decision-making.

There is a growing interest in understanding the surgical treatment decision-making process for patients with breast cancer.¹⁻⁴ Several randomized trials have demonstrated equivalent survival between breast-conserving surgery (BCS) with radiation and mastec-

We thank the American College of Surgeons Breast Cancer Department (Connie Bura and David Winchester, MD) for their support.

Address for reprints: Amy K. Alderman, MD, MPH, Assistant Professor of Surgery, Plastic and Reconstructive Surgery, University of Michigan, 2130

Taubman Center, 1500 E. Medical Center Drive, Ann Arbor, MI 48109-0340; Fax: (734) 763-5354; E-mail: aalder@umich.edu

Received July 19, 2007; revision received August 21, 2007; accepted August 24, 2007.

tomy for early stage breast cancer.^{5,6} Although the option of breast reconstruction has increased the treatment choices available to breast cancer patients,^{7,8} research has almost solely focused on surgical treatment decision-making between BCS versus mastectomy.⁹ The frequency with which general surgeons discuss breast reconstruction at the time of surgical treatment decision-making is unknown. Furthermore, it is unknown what impact this discussion may have on women's initial surgical choice (BCS vs mastectomy). All else being equal, the option of breast reconstruction may make mastectomy more appealing to women who strongly value breast preservation. There is virtually no information on whether knowledge of reconstruction before initial surgical treatment choice is associated with an increased propensity to receive mastectomy among women with early stage breast cancer.

To address this issue, we examined the impact of knowledge about breast reconstruction on the initial surgical treatment decision for breast cancer. We conducted a large population-based survey of women recently diagnosed with breast cancer to 1) describe the frequency with which general surgeons discussed options of reconstruction with their breast cancer patients at the time of initial surgical treatment decision-making; and 2) describe the impact knowing about the option of reconstruction on patients' choice for surgical treatment.

MATERIALS AND METHODS

Study Population

We performed a survey of a population-based sample of 2647 women with breast cancer identified by the Surveillance, Epidemiology and End Results Cancer (SEER) Registries of the greater metropolitan areas of Detroit and Los Angeles during a period from December 2001 to January 2003. All patients aged 79 years and younger with ductal carcinoma in situ (DCIS) and an approximate 20% random sample of patients with invasive (but not metastatic) disease were accrued into the sample during the study period.

Women with breast cancer were identified, and initial pathology reports were collected within 6 weeks of diagnosis for 90% of cases in Detroit and for nearly 100% of cases in Los Angeles. Eligible subjects underwent a definitive surgical procedure, resided within the catchment area of the SEER site, and were able to complete a questionnaire in either English or Spanish. All Asian women and all US-born women younger than 50 years of age diagnosed with invasive disease in Los Angeles during our study

period were excluded because these women were already being enrolled in other studies. Women with a diagnosis of lobular carcinoma in situ were excluded because the natural history of and recommended treatment for this diagnosis differs from that for DCIS.

We prospectively selected all cases of DCIS and a random sample of invasive cases meeting the study criteria (oversampling African American women) each month into the preliminary study sample (N = 2647). Ninety percent of all accrued cases were eligible for the study (N = 2382). The survey was completed by 77.4% of eligible patients (N = 1844). Compared with survey respondents, nonrespondents were of similar age but were less likely to be white (69.4% vs 76.6%; $P < .001$), were more likely to have stage II disease (25.2% vs 20.4%; $P = .034$), and were more likely to have received a mastectomy (34.7% vs 30.0%; $P = .021$). For this analysis, we included all patients with stage I, II, or III breast cancer and with tumors <5 cm to be consistent with guidelines of the National Cancer Institute (NCI) and National Comprehensive Cancer Network (NCCN) that include BCS and mastectomy as options for women with these clinical presentations. We excluded approximately 10% of the sample who had a clinical contraindication to either BCS or mastectomy, determined through an algorithm based on SEER clinical factors. The final sample for analysis was 1178.

A total sampling weight was calculated for each subject based on the probability of selection into the study, defined by tumor behavior (DCIS vs invasive), race/ethnicity (white, African American, other) and site (Detroit or Los Angeles). The sampling weights were normalized for each site to maintain the original sample size for statistical testing.

Data Collection and Management

Physicians were notified of our intent to contact patients. An introductory letter was sent to all potential subjects about 3 months after diagnosis followed by a telephone call to assess eligibility. A questionnaire and gift worth \$10 were mailed to all eligible women who agreed to participate and to people who could not be reached by telephone (approximately 14% of respondents). The Dillman method was used to encourage response.¹⁰

SEER clinical data from the hospital-based sources were merged with survey data for 98.2% of cases. The study protocol was approved by the institutional review boards of the University of Michigan, the University of Southern California, and Wayne State University.

Measures

The dependent variables were 1) patients' report of having a discussion about breast reconstruction with a surgeon *before* initial surgical treatment (yes/no), 2) whether or not knowing about breast reconstruction made patients more willing to consider getting a mastectomy (yes/no), and 3) whether the patient received a mastectomy (yes/no). The independent variables included patients' self-reported age, race, education, and comorbidities along with SEER-reported tumor size and tumor behavior. Age was analyzed as a continuous variable. The following categorizations for other variables were used, race (white, black, other), education (high school or less, some college or more), tumor behavior (invasive or DCIS). Comorbidities were categorized as having ≥ 1 from a list of possible chronic conditions (emphysema, heart disease, diabetes, hypertension, stroke, arthritis, or other chronic condition).

Analysis

We first described the sample by using descriptive statistics to evaluate missing values and variable distributions. We then described the proportion of the sample who discussed breast reconstruction with their general surgeon (yes/no) by the independent variables by using chi-square tests. Next, we regressed patients' reported willingness to have a mastectomy (yes/no) on reported discussion of breast reconstruction and the rest of the patient demographic and clinical factors by using logistic regression. Finally, we regressed receipt of mastectomy (yes/no) on discussion of breast reconstruction and/or willingness to consider mastectomy, and we selected covariates by using logistic regression. The Wald test and the likelihood ratio test were used to test the significance of individual predictive variables, and the model chi-square statistic was applied to test the overall significance of the model. Geographic site (Los Angeles vs Detroit) and tumor size were controlled for in all analyses. All analyses were performed with STATA software (version 8.0; StataCorp, College Station, Tex).

RESULTS

In our analytic sample of $N = 1178$, the overall mean age was 59 years old. Of the weighted sample, 71% were white, 20% African American, and 9% of other race/ethnicity. Approximately two-thirds (65%) had some college or more education. Fifteen percent reported having a comorbid condition, defined as 1 of the above-listed conditions.

Table 1 shows the weighted study-sample characteristics of patients who did and who did not discuss

TABLE 1
Characteristics of the Study Sample (N = 1178)

Variable	Discussed breast reconstruction with surgeon*		P
	Yes, N = 384	No, N = 794	
Age, y (mean, SD)	56 (11.2)	61 (11.1)	<.001*
Ethnicity			.53 [†]
White	36.4	63.6	
Black	41.3	58.7	
Other	38.9	61.1	
Education			<.001 [†]
High school or less	30.0	70.0	
Some college or more	41.9	58.1	
Tumor size (mean, SD)	2.3 (3.8)	1.9 (2.8)	.02*
Tumor behavior			.49 [†]
DCIS	40.1	59.9	
Invasive	36.6	63.4	
Comorbid conditions			.84 [†]
Yes	37.2	62.8	
No	38.5	61.6	

DCIS indicates ductal carcinoma in situ.

* Student *t* test.

[†] Chi-square.

breast reconstruction with their general surgeon. Only 33% of patients had a general surgeon discuss breast reconstruction with them during the surgical decision-making process for their cancer. Patients who discussed reconstruction with their surgeon were significantly younger than those who did not (mean age 56 vs 61 years, respectively; $P < .001$), had larger mean tumor sizes (2.3 cm vs 1.9 cm, respectively; $P = .02$), and were more educated (41.9% of those with some college or more vs 30.0% of those with high school or less; $P < .001$). No differences were noted by patient race, tumor behavior, or comorbid conditions.

Table 2 shows the associations between knowing about breast reconstruction and patients' self-reported willingness to think about having a mastectomy while controlling for selected demographic and clinical covariates. Patients who discussed breast reconstruction with their surgeon were significantly more willing to consider having a mastectomy compared with those who did not have this discussion (OR, 2.06; $P < .001$). We tested the interactions between patient age and discussing reconstruction on willingness to have a mastectomy, and these interaction terms were not significant in the model. Table 3 shows the association between patient report of reconstruction discussion and receipt of mastectomy while controlling for important covariates. Patients who discussed reconstruction were more than 4 times

TABLE 2
Multivariate Logistic Regression of Breast Cancer Patients' Willingness to Have a Mastectomy

Variable	OR (95% CI)	P
Discussed breast reconstruction with general surgeon (yes/no)	2.06 (1.40, 3.03)	<.001
Age	0.95 (0.93, 0.97)	<.001
Race/Ethnicity		
White	—	—
Black	0.45 (0.27, 0.71)	.003
Other	0.72 (0.36, 1.45)	.362
Education		
Some high school or graduate	—	—
Some college or graduate	0.92 (0.61, 1.40)	.698
Comorbidities (yes/no)	0.86 (0.45, 1.69)	.664

The model controlled for geographic location (Detroit, Los Angeles), tumor size, and tumor behavior.

more likely to receive a mastectomy (OR, 4.48; $P < .001$).

DISCUSSION

In this large population-based study, we found that only 33% of patients eligible for mastectomy or BCS reported that their general surgeon discussed breast reconstruction with them during the surgical decision-making process. Younger patients with higher levels of education were more likely to report having this discussion with their surgeon than their counterparts. Perhaps most importantly, we found that having a discussion about reconstructive options significantly increased patients' willingness to consider a mastectomy. As would be expected, having this discussion strongly influenced surgical treatment choices; those who reported having had a discussion about reconstruction were more than 4 times more likely to receive a mastectomy compared with those who did not.

These results suggest that the option of breast reconstruction is intimately tied to patient's choice of surgery and significantly increases the likelihood that a patient eligible for both options will choose mastectomy. The surgical treatment of early stage breast cancer is a preference-sensitive decision that has historically focused on the surgical options of BCS and mastectomy.^{9,11} Our findings indicate that this traditional surgical decision-making paradigm for breast cancer may need to be adapted to include the option of reconstruction during the initial surgical treatment discussion. Women eligible for reconstruction at the time of the mastectomy (immediate reconstruction) are those with early stage disease (stage I or II) who

TABLE 3
Multivariate Logistic Regression of Receipt of Mastectomy

Variable	OR (95% CI)	P
Discussed breast reconstruction with general surgeon (yes/no)	4.48 (3.31, 6.06)	<.001
Age	1.01 (0.99, 1.02)	.40
Race/Ethnicity		
White	—	—
Black	1.46 (1.03, 2.08)	.04
Other	2.15 (1.33, 3.47)	.002
Education		
Some high school or graduate	—	—
Some college or graduate	0.53 (0.39, 0.72)	<.001
Comorbidities	1.36 (0.80, 1.48)	.585

The model controlled for geographic location (Detroit, Los Angeles), tumor size, and tumor behavior.

are at a low risk for postmastectomy radiation. And, compared with delayed procedures, tissue expander/implant or autogenous tissue reconstructions performed at the time of the mastectomy are associated with better esthetic and psychological outcomes.¹²

These results underscore the importance of informing patients about the option of breast reconstruction *before initial surgical choice*. Others have shown that multidisciplinary cancer care, including consultations with medical and/or radiation oncologists before surgery, influences the ultimate surgical choice.^{13,14} In addition, Hawley et al. showed that a surgeon's propensity to refer patients with breast cancer to a plastic surgeon before surgical cancer treatment explained a substantial amount of between-surgeon variation in use of reconstruction.¹⁵ Our results augment this research by suggesting that discussion of reconstruction before surgery will also impact initial surgical treatment decision-making. Taken together, this research suggests that patients should be informed of all options to be educated consumers of healthcare and to ensure maximal breast cancer treatment decision quality.

The reason for our finding that younger, more highly educated patients more often reported a discussion of breast reconstruction is unclear. Breast reconstruction occurs more commonly among younger women,¹⁶ but whether this is driven by patient preference, physician bias, or clinical contraindications is unknown. In the era of sentinel lymph node biopsy, BCS in the lymph node-negative patient is an outpatient surgical procedure that is associated with a considerably more rapid return to full activity than a mastectomy with reconstruction. Our work has previously shown that interruption of the activities of

daily life is a more important factor in treatment decisions for older women than their younger counterparts,¹⁷ and this may in part account for the relation between age and reconstruction observed in this and other studies. In addition, patients with higher levels of education may take more initiative to be well-informed consumers of healthcare and, therefore, possibly initiate this discussion. Nevertheless, our results suggest a need for comprehensive breast cancer treatment decision aids, including information on initial surgery and other treatment options such as reconstruction. These tools need to be able to convey information to patients with different demographic and clinical characteristics.

Limitations

Our findings should be interpreted in the context of some limitations. These results are limited to 2 metropolitan areas, Detroit and Los Angeles, and may not reflect national trends in breast cancer care. However, the large racially and ethnically diverse population-based patient samples and the high response rate suggest that we have a sample that is well representative of breast cancer patients in the US. We were also limited by the self-reported nature of our outcome variables, which may be subject to recall bias. A related issue is that we were not able to determine whether reconstruction discussions were initiated by patients or surgeons. In some cases, surgeons might have appropriately tailored the discussion of treatment options on the bases of the patients stated preference for BCS and lack of interest in mastectomy options. Lastly, the study was necessarily retrospective in design. Patients' recall of their encounters with clinicians may vary because of the passage of time or be influenced by their treatment experiences.

Implications

Our results have important implications for patient care and policy. First, our findings suggest that the underlying paradigm of informed breast cancer treatment decision-making may need to change to include mastectomy with the option of reconstruction, especially for patients who have clinical contraindications to BCS, those who express a preference for treatment with mastectomy, and those who are uncertain about their treatment choice. To achieve this shift, general surgeons should consider incorporating discussions of reconstruction or referring patients to plastic surgeons before the patient's surgical decision. Our prior research in this area found that only 24% of general surgeons report referring 75% or more of their

mastectomy patients to plastic surgeons as part of their standard practice.¹⁸ These data suggest that higher rates of referral could have a measurable impact on surgical treatment outcomes. In addition, efforts to improve surgeons' propensity to discuss reconstruction or refer to plastic surgeons need to emphasize the importance of doing so across all types of patients, regardless of patient demographic or clinical factors. Finally, decision tools that include accurate information about all treatment options will improve the quality of breast cancer treatment decision-making. Such decision tools could also stimulate patients to raise the issue of breast reconstruction with their general surgeon.

REFERENCES

1. Vrakking AM, van der Heide A, van Delden JJ, Looman CW, Visser MH, van der Maas PJ. Medical decision-making for seriously ill non-elderly and elderly patients. *Health Policy*. 2005;75:40-48.
2. Katz SJ, Lantz PM, Janz NK, et al. Patient involvement in surgery treatment decisions for breast cancer. *J Clin Oncol*. 2005;23:5526-5533.
3. Nattinger AB. Variation in the choice of breast-conserving surgery or mastectomy: patient or physician decision making? *J Clin Oncol*. 2005;23:5429-5431.
4. Lantz PM, Janz NK, Fagerlin A, et al. Satisfaction with surgery outcomes and the decision process in a population-based sample of women with breast cancer. *Health Serv Res*. 2005;40:745-767. Comment in: *Health Serv Res*. 2005;40:769-779.
5. Fisher B, Redmond C, Poisson R, et al. Eight-year results of a randomized clinical trial comparing total mastectomy and lumpectomy with or without irradiation in the treatment of breast cancer. *N Engl J Med*. 1989;320:822-828. Erratum in: *N Engl J Med*. 1994;330:1467.
6. Sarrazin D, Le MG, Arriagada R, et al. Ten-year results of a randomized trial comparing conservative treatment to mastectomy in early breast cancer. *Radiother Oncol*. 1989;14:177-184.
7. Alderman AK, Wilkins EG, Lowery JC, Kim M, Davis JA. Determinants of patient satisfaction in postmastectomy breast reconstruction. *Plast Reconstr Surg*. 2000;106:769-776.
8. Kronowitz SJ, Hunt KK, Kuerer HM, et al. Delayed-immediate breast reconstruction. *Plast Reconstr Surg*. 2004;113:1617-1628.
9. Waljee JF, Rogers MA, Alderman AK. Decision aids and breast cancer: do they influence choice for surgery and knowledge of treatment options? *J Clin Oncol*. 2007;25:1067-1073.
10. Dillman D. Mail and Telephone Surveys. New York: John Wiley; 1978.
11. Dartmouth Medical School Center for the Evaluative Clinical Sciences [corporate author]. The Dartmouth Atlas of Health Care. 3rd ed. Chicago: American Hospital Publishing; 1999.
12. Kronowitz SJ, Kuerer HM. Advances and surgical decision-making for breast reconstruction. *Cancer*. 2006;107:893-907.

13. Baldwin LM, Taplin SH, Friedman H, Moe R. Access to multidisciplinary cancer care: is it linked to the use of breast-conserving surgery with radiation for early-stage breast carcinoma? *Cancer*. 2004;100:701-709.
14. Keating NL, Landrum MB, Ayanian JZ, Winer EP, Guadagnoli E. Consultation with a medical oncologist before surgery and type of surgery among elderly women with early-stage breast cancer. *J Clin Oncol*. 2003;21:4532-4539.
15. Hawley ST, Hofer TP, Janz NK, et al. Correlates of between-surgeon variation in breast cancer treatments. *Med Care*. 2006;44:609-616.
16. Alderman AK, McMahon L Jr, Wilkins EG. The national utilization of immediate and early delayed breast reconstruction & the impact of sociodemographic factors. 1: *Plast Reconstr Surg*. 2003;111:695-703; discussion 704-705.
17. Opatt D, Morrow M, Hawley S, Schwartz K, Janz NK, Katz SJ. Conflicts in decision-making for breast cancer surgery. *Ann Surg Oncol*. 2007;14:2463-2469.
18. Alderman AK, Hawley ST, Waljee J, Morrow M, Katz SJ. Correlates of referral practices of general surgeons to plastic surgeons for mastectomy reconstruction. *Cancer*. 2007;109:1715-1720.