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The necessity of the nipple: redefining completeness in breast reconstruction

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Abstract

Introduction—Satisfaction with breast reconstruction is thought to be greatest among patients who complete nipple and areolar-complex (NAC) reconstruction. Anecdotally, many patients are known to decline NAC reconstruction. The authors aimed to characterize the epidemiology of and factors associated with incomplete breast reconstruction.

Methods—Breast reconstruction patients with follow-up in a single institution's electronic medical record system were reviewed. Chi-squared and independent t-tests were used to identify variables associated with lack of NAC reconstruction; associated variables ($p < 0.05$) were used to build a binary logistic regression.

Results—Four hundred thirty-three patients were reviewed. Reconstructions consisted of an average of 4.0 ± 2.0 procedures over 503 (range 2–3,652) days. One hundred twelve patients had NAC reconstruction or tattooing (25.9%) and 73 (17.6%) had both – 226 women (54.6%) had neither. On multivariate analysis, a history of any implant removal was associated with a 93.4% decreased chance of NAC reconstruction ($p = 0.002$), while prophylactic or early stage mastectomy was associated with 52.9% increased chances of NAC reconstruction ($p = 0.009$).

Conclusions—Over half of the present cohort did not complete any NAC reconstruction. Patients with later-stage cancer and a history of implant removal were less likely to have NAC reconstruction. The high prevalence of incomplete reconstructions suggests that the classical definition of breast reconstruction completion as requiring NAC reconstruction may be outdated or

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not applicable to all populations. Instead, “completion” should be considered a subjective determination varying between patients.

Introduction

Breast reconstruction following mastectomy is a complex process involving many factors, including mastectomy type, surgical approach, and patient priorities and goals. The vast majority of reconstructions require multiple procedures, including those necessary to achieve a final, durable result (e.g. flap inseting, permanent implant exchange for tissue expanders, etc.) as well as those designed to provide more aesthetically pleasing reconstructed breasts (e.g. nipple and areola reconstruction, fat grafting, etc.). For example, Eom et al.¹ reported a series of reconstructions that required an average of 2.37 procedures and Losken et al. reported an average of 3.99 secondary procedures for unilateral reconstructions and 5.54 for bilateral reconstructions.²

Reconstruction of the nipple and areolae is commonly used as a surrogate for completion. Nipple and areolar complex (NAC) reconstruction has been associated with increased satisfaction with breast reconstruction outcomes.^{3,4,5} There may also be other procedures that a surgeon or patient feel are necessary for the subjective evaluation of “completeness.” “Completion” of breast reconstruction therefore requires a range of both necessary and aesthetically-driven operations.

Breast reconstruction can be a years-long process and patients must navigate many aspects of cancer care during this time in addition to other personal and health concerns. Anecdotally, a large group of patients seem to grow fatigued by the number of reconstructions and the duration of which they occur. This “reconstruction fatigue” leads to patients declining procedures due to the pain, anxiety, hassle, exhaustion, or distress associated with them. Reported proportions of women not undergoing nipple reconstruction vary widely, from near 10%⁶ to 50%⁷ and even higher.^{1,8} However, no studies have examined factors associated with lack of NAC reconstruction. The authors of the present study aimed to measure the prevalence of lack of NAC reconstruction and evaluate associated factors.

PATIENTS AND METHODS

A retrospective medical chart review of female patients undergoing procedures consistent with breast reconstruction between October 2003 and September 2015 was performed. Non-breast cancer patients, patients whose breast reconstruction procedures were revisions of procedures done at outside institutions, and those whose primary plastic surgeons did not write notes in our institution's electronic medical record system were excluded (**Figure 1**). Records were reviewed for demographic data, including age at mastectomy and reconstruction, ethnicity, and BMI. Medical comorbidities (hypertension, hyperlipidemia, coronary artery disease, diabetes, depression, and anxiety) and tobacco use were also recorded, as was past surgical history, including specifically breast surgery and cosmetic surgery procedures. Patients who were actively smoking at the time of initial plastic surgery assessment were considered to be current smokers.

Details of patients' breast cancers were reviewed, including stage and neo-adjuvant and adjuvant therapies. Breast surgery laterality, axillary dissection, and reconstruction type and timing were collected. Post-operative complications and re-operations were recorded over the entire course of patient follow-up (from time of reconstruction to the end of 2015; at least 3 months in all patients) and included mastectomy skin necrosis, hematoma, seroma, need for anastomotic revision, partial or complete flap loss, wound dehiscence, cellulitis, peri-implant infections, abscesses, and implant exposure/extrusion. Mastectomy skin necrosis was considered to have occurred when remarked upon in patient notes. Hematoma and seroma were considered similarly, regardless of whether they required intervention. Dehiscence was recorded when it required intervention in the operating room, in the office, or in the form of specific wound care. Infections were considered to have occurred when a patient was treated for suspected infection, even in the absence of operative intervention or cultures. Patients were recorded as having a superficial versus deep or peri-implant infection if 1) the infection appeared to be cellulosic and no operative intervention was taken or 2) no fluid accumulations were seen on imaging or during surgery. Patients were considered to have incomplete reconstructions if they did not undergo either surgical nipple reconstruction or NAC tattooing – patients who had one and not the other were considered to have had NAC reconstructions and to have completed their reconstructive course.

Statistics were run in IBM SPSS Statistics version 20 (Armonk, NY). Univariate analysis was run with incomplete reconstructions (lack of NAC reconstruction) as an independent variable in chi-squared, t- and Mann-Whitney U tests, and demographic, comorbidity, cancer, and reconstruction characteristics as dependent variables, based off factors that could reasonably affect reconstruction choices. Multivariate analysis was run using variables found to be significant ($p < 0.05$) on univariate analysis (i.e., after a variable reduction strategy). The present study was approved by the Mount Sinai IRB (HSM# 15-00922).

Results

Patient Demographics

Four hundred thirty-three patients were reviewed, of whom 206 were of Caucasian ethnicity (47.6%, **Table 1**). The majority of patients had private insurance ($N=256$, 59.1%). The average age of these women was 50.6 ± 14 years and average BMI 27.2 ± 5.7 . One hundred ten patients (25.4%) had two or more comorbidities and 35 (8.1%) smoked. Two hundred thirty-nine women (55.2%) were married or in a committed relationship and 272 (62.8%) had children.

One hundred eighty-five mastectomies (42.7%) were bilateral. Twenty patients underwent prophylactic mastectomy (4.6%) and 177 (40.9%) had early stage (stage 0 or 1) cancer. One hundred ten patients (25.4%) had a full axillary dissection, 142 (32.8%) received post-operative radiation, and 225 (52.0%) received adjuvant or neo-adjuvant chemotherapy. Two hundred eighty-two patients (65.1%) underwent implant-based reconstruction. The vast majority of reconstructions were immediate ($N=391$, 90.5%). Reconstructions consisted of an average of 4.0 ± 2.0 procedures over 503 (range 2-3,652) days.

Nineteen patients had nipple-sparing mastectomies (4.4%); these patients were excluded from further analysis as these patients do not require NAC reconstruction. Patients undergoing nipple-sparing mastectomy were younger (44.3 ± 8.8 versus 50.9 ± 14.2 , $p=0.044$) and weighed less (BMIs 23.9 ± 3.7 versus 27.3 ± 5.7 , $p=0.010$). There was no difference between patients undergoing or not undergoing nipple sparing mastectomy based on race/ethnicity (Caucasian $p=0.357$, African-American $p=0.059$, Asian $p=0.155$, Hispanic $p=0.7390$), private insurance status ($p=0.780$), prophylactic or early stage mastectomy ($p=0.114$), or receipt of radiation ($p=0.106$) or chemotherapy ($p=0.069$).

Factors associated with lack of NAC reconstruction

One hundred sixty-six patients (40.1%) had nipple reconstruction and 95 (22.9% overall) had nipple tattooing – 226 women (54.6%) had neither and 73 (17.6% overall) had both. In univariate analysis (**Table 2**), there were no significant differences between patients undergoing NAC reconstruction and those who did not in terms of age, BMI, comorbidities, and most cancer and reconstructive variables. Patients undergoing prophylactic or early stage mastectomies (OR 1.67, 1.13-2.47) were more likely to undergo NAC reconstruction. Patients with a history of implant removal were less likely to undergo NAC reconstruction (OR 0.40, 0.22-0.73). Only hypertension was associated with NAC reconstruction, with hypertensive patients marginally less likely to receive NAC reconstruction or tattooing (OR 0.65, 0.43-0.99).

Variables significant on univariate analysis were entered into a multivariate regression (**Table 3**). Prophylactic or early stage mastectomy increased likelihood of NAC reconstruction by 53.9% ($p=0.008$). History of any implant removal without replacement decreased chances of NAC reconstruction by 88.8% ($p=0.004$).

Discussion

Over half of this current cohort did not complete breast reconstruction defined as lack of any form of NAC reconstruction. Patients with later-stage cancer or non-prophylactic mastectomies and a history of implant removal were less likely to have NAC reconstruction.

NAC reconstruction is often considered both aesthetically advantageous and a marker of breast reconstruction completion.^{3,4,5,6,7,8,9} However, much of this research is outdated, problematic, or both. The majority of studies on the subject have relied on retrospective questionnaires.^{3,4,5,7} One of the studies sometimes cited as evidence of the aesthetic necessity of NAC reconstruction actually reported statistically insignificant results.⁹ Wellisch et al. reported higher aesthetic satisfaction with NAC reconstruction among 59 patients but did not control for the fact that patients having NAC reconstruction were younger.⁵ Furthermore, although the Wellisch et al. paper is frequently cited, it is nearly twenty years old and a product of its time (one example: “The popular styles and fabrics of today’s fashions encourage a subtle yet obvious presentation of a woman’s projected nipple.”)⁵ The Ramon et al. findings of similar outcomes among a small number of implant-based reconstruction patients are also nearly two decades old.¹⁰

Although Shaikh-Naidu et al. also reported NAC reconstruction to be associated with higher satisfaction on multiple aesthetic parameters following multivariate analysis in a population of 211 patients, the study is over a decade old and unfortunately did not report the overall percentage of patients undergoing NAC reconstruction.³ Momoh et al. reported on the importance of NAC reconstruction more recently.⁴ In that sample, fewer patients underwent implant-based reconstruction than autologous reconstruction and NAC reconstruction was much less common among patients receiving implants. It is therefore unclear whether the increased satisfaction associated with NAC reconstruction in their population was biased by the very low rates of implant-based reconstruction and NAC reconstruction among implant-based patients.

Regardless of any aesthetic or psychological benefit of NAC reconstruction, the number of women undergoing it has varied widely. Reports of rates of NAC reconstruction range from more than three quarters of patients^{6,11,12} to less than a quarter of patients.^{10,13} The finding in the present study that 54.6% of patients did not undergo NAC reconstruction is similar to some other estimates.^{7,14}

Though two prior studies have examined the factors affecting the length of time¹⁵ and number of procedures¹⁶ required to complete reconstruction, no previous research has looked at which patients complete reconstruction and which do not. Wellisch et al. and Momoh et al. noted that patients having NAC reconstruction happened to be younger; this was not seen in the present sample. The factors affecting whether women finished reconstruction in the present sample (a history of implant removal and higher cancer stage) are unfortunately non-modifiable. However, even these two non-modifiable factors may potentially illuminate the decision-making process among breast reconstruction patients. Management of both more advanced cancer and reconstruction complications may use up the time and energy that would have otherwise been spent on completing reconstruction. The time and energy a woman is willing to devote to reconstruction might be considered a fixed quantity beyond which the advantages of further procedures are outweighed by fatigue with the process. The amount of time and energy available is likely a function of personal preferences regarding breast aesthetics as well as how important a patient considers her appearance to be.

The authors were encouraged to find that demographic factors including insurance type, ethnicity, and socioeconomic indicators were not associated with completion of breast reconstruction, suggesting that patients were not prevented from completing reconstruction on the basis of ethnicity, insurance status, or socioeconomic factors. Diagnoses of anxiety and depression – both of which might reasonably be expected to affect reconstruction choices and motivation to complete reconstruction – were also not associated with lack of NAC reconstruction. Of additional interest to the authors was that 5.3% percent of patients had NAC tattooing without surgical NAC reconstruction. It seems the popularization of three-dimensional NAC tattooing¹⁷ has allowed some women to have the symmetrizing benefit of a nipple-areolar complex without surgery. Although nipple projection has previously been reported as a desirable outcome in some of the older studies on the subject, anecdotally many women prefer to mask nipple projection (as evidenced by the sizeable cottage industry surrounding “dimers” and other silicone nipple shields). This is clearly a

function of changing times and fashions and the culturally desirable breast will most likely change again in time. However, it seems that currently a large number of breast reconstruction patients do not find NAC reconstruction or tattooing to be essential to the completeness of their breast reconstruction.

There are some disadvantages to the current study. For one, because of its retrospective nature, attempts to understand why some women forgo NAC reconstruction are conjectural. It is possible that bias may have been introduced by the exclusion of women whose surgical follow-up was not included in our institution's medical record system. Furthermore, because no measures of aesthetic or general satisfaction were assessed in this population, it is possible that the large number of women without NAC reconstruction were less satisfied with their reconstructions. Finally, the range of follow-up times was very wide, from over a decade to a few months – it is possible that some patients will subsequently choose to undergo nipple reconstruction in the future.

However, this is the first study to examine factors associated with lack of NAC reconstruction and establishes that completion of breast reconstruction in the classical sense is uncommon. The study population is large and diverse and included a range of cancer stages and mix of reconstructive modalities. The authors propose that completion be considered a subjective endpoint assessed on a patient-by-patient basis. Reconsideration of this convenient endpoint might complicate future breast reconstruction research but may result in patients feeling more empowered to personalize their breast reconstruction experience.

Conclusion

Lack of NAC reconstruction was associated with a history of implant removal and more advanced cancer. The extremely high prevalence of non-completion in the present sample suggests that “completion” may be a subjective determination varying between patients. Surgeons should be aware of their own internal biases about the necessity of certain procedures and be willing to adopt the patient's prioritization of procedures, rather than pushing women towards classically complete breasts. Further prospective research incorporating qualitative patient input should be done to determine whether lack of NAC reconstruction is an indicator of reconstruction completion from patients' points of view or merely a convenient, conventional, marker.

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Figure 1.
Flow-chart of patient inclusion and exclusion criteria

Table 1

Demographic and cancer-related descriptive statistics

Demographic statistics	N (%) or mean±SD
Caucasian	206 (47.6)
African American	66 (15.2)
Hispanic ethnicity	81 (18.7)
Asian	18 (4.2)
Other race/ethnicity	19 (4.4)
Average age	50.6±14 years
Private insurance	256 (59.1)
Average BMI	27.2±5.7
Current smokers	35 (8.1)
Married or committed relationship	239 (55.2)
Any children	272 (62.8)
Comorbidities	
Hypertension	133 (30.7)
Hyperlipidemia	78 (18.0)
Diabetes	40 (9.2)
Coronary artery disease	8 (1.8)
Depression	69 (15.9)
Anxiety	39 (9.0)
Mastectomy statistics	
Prophylactic mastectomy	20 (4.6)
Stage 0 or 1 cancer	177 (40.9)
Axillary dissection	110 (25.4)
Adjuvant radiation	142 (32.8)
Neoadjuvant chemotherapy	49 (11.3)
Adjuvant chemotherapy	185 (42.7)

Table 2

Univariate analysis of factors associated with nipple/areolar complex reconstruction

Factor	NAC reconstruction	No NAC reconstruction	p value
Age	50.3±10.4	51.4±16.6	0.441
BMI	27.3±5.3	27.4±6.1	0.880
Number of comorbidities	0.89±1.1	1.09±1.4	0.130
Number of complications	0.6±0.9	0.5±1.0	0.832
Odds Ratio (95% confidence interval)			
Caucasian ethnicity	1.14 (0.78-1.69)		
Hispanic ethnicity	1.62 (0.99-2.66)		
African American ethnicity	0.87 (0.51-1.47)		
Private insurance	1.06 (0.71-1.58)		
Full time job	0.90 (0.43-1.86)		
Married or relationship	1.06 (0.71-1.58)		
Any children	1.47 (0.98-2.20)		
Current smoking	0.94 (0.46-1.90)		
Immediate reconstruction	1.20 (0.63-2.31)		
Early stage or prophylactic mastectomy	1.67 (1.13-2.47) *		
Implant-based reconstruction	0.70 (0.47-1.06)		
Acellular dermal matrix use	0.93 (0.20-4.41)		
Reconstruction failure	0.67 (0.28-1.59)		
Full axillary dissection	0.97 (0.62-1.50)		
Radiation	0.76 (0.51-1.15)		
Chemotherapy	1.20 (0.81-1.76)		
Any dehiscence	1.30 (0.81-2.10)		
Any seroma	1.44 (0.85-2.46)		
Any skin necrosis	1.03 (0.65-1.66)		
Any implant exposure	1.21 (0.47-3.12)		
Any implant removal	0.40 (0.22-0.73) *		
Any hematoma	0.83 (0.45-1.54)		
Any infection	0.99 (0.61-1.60)		

* Significant, p<0.05

Table 3

Multivariate analysis of factors associated with nipple/areolar complex reconstruction

Factor significant on univariate analysis	OR (95% CI)	B	p value
Implant removal without replacement	0.39 (0.21-0.71)	-0.942	0.002 *
Prophylactic or early stage mastectomy	1.73 (1.15-2.58)	0.545	0.008 *

* Significant, $p < 0.05$