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ORIGINAL ARTICLE – BREAST ONCOLOGY

Breast Cancer Found Incidentally After Reduction Mammaplasty in Young Insured Women

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ABSTRACT

Background. Reduction mammaplasty is a common operation performed for healthy women. The estimated incidence of breast cancer diagnosed at the time of reduction mammaplasty varies from 0.06 to 4.5%, and information on the care of these patients is limited. This study aimed to determine the incidence of breast cancer identified incidentally during reduction mammaplasty and to characterize preoperative imaging.

Methods. Women 18 years of age or older who underwent reduction mammaplasty from 2013 to 2015 were identified from the Truven Health MarketScan® Research Databases. Patients with prior breast cancer were excluded. Descriptive statistics were calculated for patient characteristics, incidental breast cancer, preoperative breast imaging, and postoperative treatment.

Results. Reduction mammaplasty was performed for 18,969 women with a mean age of 42.5 years. Of these patients, 186 (0.98%) were incidentally found to have breast cancer, with 134 (0.71%) having invasive breast cancer and 52 (0.27%) having carcinoma in situ. The patients with incidentally found cancer were older than the patients without cancer (50.8 vs. 42.5 years; $p < 0.001$). Overall, 58.2% of the patients had undergone mammography before reduction mammoplasty. The rates were higher (> 80%) for the patients older than 40 years. Preoperative mammography was performed for 76.3% of those with a diagnosis of breast cancer at time of reduction mammoplasty.

Conclusions. Breast cancer diagnosed incidentally at the time of reduction mammaplasty is uncommon and often radiographically occult. The majority of women older than 50 years appropriately received preoperative mammography. These data can be used to manage patient expectations about the potential for the incidental diagnosis of breast cancer at reduction mammaplasty, even with a negative preoperative mammography.

Reduction mammaplasty is a common procedure performed for healthy women. In 2017, 103,098 reduction mammaplasties were performed in the United States according to the American Society of Plastic Surgeons.[1] The age of patients who undergo reduction mammaplasty ranges from adolescence to elderly.[2] Reduction mammaplasty for patients with macromastia is effective and improves physical symptoms including neck pain, shoulder pain, back pain, and headache as well as psychological symptoms including anxiety, depression, and body image.[3–5] In addition, overall quality of life increases after reduction mammaplasty.[4,6]

Some women who undergo reduction mammaplasty are incidentally found to have breast cancer. However, estimates of the incidence are highly varied. Prior studies have reported rates of incidentally found breast cancer ranging from 0.06 to 4.5%.[2,7–15] A personal history of breast cancer or older age increases the risk of finding breast cancer incidentally.[7,8] Use of preoperative breast imaging can decrease the likelihood of finding breast cancer incidentally at the time of reduction mammaplasty.

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According to a continuing medical education article from the American Society of Plastic Surgeons, the decision to obtain preoperative mammography should be based on the patient's personal history, family history, physical exam, and age.[16] The authors recommend that all patients older than 50 years undergo a preoperative mammogram before reduction mammoplasty, consistent with current screening guidelines.[17,18] However, they also recommend consideration of preoperative mammogram for all women older than 40 years due to the perceived importance of identifying any breast cancer preoperatively.[16]

For patients incidentally found to have breast cancer at the time of reduction mammaplasty, surgical treatment options can be limited due to lack of specimen orientation and difficulty locating where in the breast the cancer originated.[19,20] Consequently, completion mastectomy often is the treatment considered.[19,20] Furthermore, preoperative mammogram is important because ability to screen the breast after reduction mammoplasty is limited due to changes in the architecture of the breast and challenges comparing postoperative films with prior screening mammograms.[21,22]

Currently, information is limited regarding the incidence of breast cancer found incidentally in women undergoing reduction mammaplasty and how the incidence is influenced by the use of preoperative imaging.

The primary goal of this study was to understand more precisely the incidence of breast cancer found incidentally at the time of reduction mammaplasty and to characterize the use of breast imaging before reduction mammaplasty. A secondary goal of this study was to describe the treatment of patients incidentally found to have breast cancer.

METHODS

Data Source and Study Population

Truven Health MarketScan Research Databases (Truven Health Analytics, Inc., Ann Arbor, MI, USA) includes national claims data from more than 40 million patients with mainly employer-provided health insurance and Medicare supplemental insurance plans. The MarketScan databases capture complete episodes of care including claims for outpatient office visits (e.g., physician, imaging), inpatient admissions, and pharmacy claims.

Women 18 years of age or older who underwent reduction mammaplasty from 2013 to 2015 were identified from the Truven Health MarketScan databases using Current Procedural Terminology (CPT) procedure codes 19318 (reduction mammaplasty) and 19318-50 (reduction mammaplasty-bilateral) as well as International Classification of Diseases, Ninth Revision (ICD-9) codes 85.31 (unilateral reduction mammaplasty) and 85.32 (bilateral reduction mammaplasty) (see "Appendix"). We selected these years because they were the most recent data available at the initiation of the study.

Other inclusion criteria for the study cohort specified female sex and complete claims data for at least 1 year before the reduction mammoplasty. Patients who had a prior diagnosis of breast cancer within 12 months before their reduction mammoplasty were excluded from the study. Patients with a lumpectomy or mastectomy on the same day as reduction mammaplasty also were excluded. Only those with continuous insurance coverage for at least 6 months after reduction mammaplasty (77.4%) and with insurance coverage for prescription drugs (82.8%) were included in the treatment analysis.

Variables

The patients were categorized as having breast cancer found incidentally at the time of reduction mammaplasty if a breast cancer diagnosis was determined 0–30 days after the operation. The patients with a family history of breast cancer and obesity were identified using ICD-9 codes. Preoperative breast imaging was defined as mammography, breast magnetic resonance imaging (MRI), or breast ultrasound within 1 year before reduction mammaplasty using ICD-9 and CPT codes (see "Appendix").

For the patients with breast cancer found incidentally at the time of reduction mammaplasty, we characterized the treatment for breast cancer during the next 6 months. Treatment included lumpectomy, mastectomy, radiation, and chemotherapy, identified through ICD-9 and CPT codes (see "Appendix"), as well as endocrine therapy, identified through National Drug Codes.

Statistical Analysis

The incidence of breast cancer found incidentally at the time of reduction mammaplasty was calculated. Descriptive statistics for patient characteristics, preoperative breast imaging, and treatment after an incidental diagnosis of breast cancer were calculated. Cell sizes that included fewer than 10 patients were not reported due to the MarketScan databases standards. Student *t* tests were used to compare patient characteristics between those without breast cancer found incidentally and those incidentally found to have breast cancer at the time of reduction mammaplasty.

All statistical analyses were performed with SAS, version 9.4 (SAS Institute Inc, Cary, NC, USA). A waiver from the institutional review board was obtained.

RESULTS

This study cohort comprised 18,969 patients who underwent reduction mammaplasty, 186 (0.98%) of whom had a new breast cancer diagnosis at the time of reduction mammaplasty. Of these 186 patients, 134 (0.71%) were found to have invasive breast cancer, and 52 (0.27%) were found to have carcinoma in situ (Table 1). Those with breast cancer found at time of reduction mammaplasty were older than those who did not have incidentally found breast cancer (mean age, 50.8 vs. 42.5 years; $p < 0.001$). The incidence of new breast cancer ranged from 0.30% for those younger than 40 years to 1.87% for those 55 years of age or older (Fig. 1).

Mammography was performed before surgery for 11,040 (58.2%) of those who underwent reduction mammaplasty. The proportion of patients who underwent preoperative mammography differed by patient age, with preoperative mammography performed for 18.4% of the patients younger than 40 years, 81.8% of those 40–44 years old, 84.2% of those 45–49 years old, 85.6% of those 50–54 years old, and 83.3% of those 55 years of age or older.

Preoperative breast MRI was performed for 106 (0.6%) of the patients and preoperative breast ultrasound for 2118 (11.2%) of the patients. More than half of the patients (59.6%) had any form of breast imaging (Table 2). The patients incidentally found to have breast cancer at the time of reduction mammaplasty included 142 (76.3%) who had received a preoperative mammogram. Among those with a diagnosis of breast cancer found incidentally, the percentage of patients who underwent preoperative mammogram decreased with increasing age, with percentages ranging from 91.7% of those 40–44 years old to 77.7% of those 55 of age or older (Table 2).

The study cohort included 120 patients with breast cancer diagnosed incidentally and a follow-up period of at least 6 months. The majority of the patients (75.8%) had no further locoregional treatment after reduction mammaplasty. Only 13 patients (10.8%) with newly diagnosed breast cancer underwent a reoperation mastectomy, and none had a reoperation lumpectomy.

Of the patients who underwent reduction mammaplasty, 16 (22.5%) received only radiation. Endocrine therapy was received by 27 (22.5%) of the patients with newly diagnosed breast cancer. This rate was higher for the women with newly diagnosed carcinoma in situ (n = 13/28, 46.4%) than for the women with invasive cancer (n = 14/92, 15.2%). Although some of the patients received chemotherapy, the number was too low to report per Marketscan standards (Table 3).

TABLE 1 Patient characteristics

Characteristic (n = 18,969)	% (n)
Mean age (years)	42.6 ± 12.9
New breast cancer	0.98 (186)
New invasive breast cancer	0.71 (134)
New carcinoma in situ	0.27 (52)
Family history of breast cancer	5.1 (968)
Obesity	20.7 (3924)

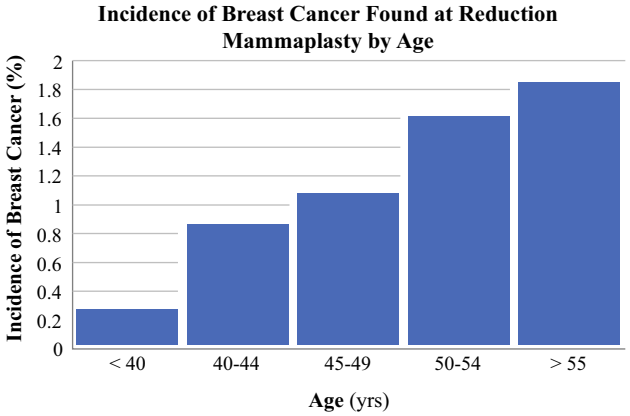

FIG. 1 Histogram showing the incidence of breast cancer found at reduction mammaplasty by age

DISCUSSION

Breast cancer found incidentally at the time of reduction mammaplasty is uncommon. The study findings showed an overall incidence of 0.98%, with an incidence of 0.71% for invasive breast cancer and 0.27% for carcinoma in situ. As expected, older patients were more likely have a diagnosis of incidentally found breast cancer. The majority of the women older than 40 years had preoperative mammography performed, including those found to have incidentally found breast cancer. The majority of the women with incidentally found breast cancer had no further locoregional treatment, and a minority of patients underwent systemic therapy including chemotherapy and endocrine therapy.

Our study of 18,969 women represented a large cohort of patients who underwent reduction mammaplasty. The rate of incidentally found breast cancer that we found was consistent with that reported in prior literature (0.06–4.5%).[2,7–15] However, we found a higher incidence of incidentally found invasive breast cancer than incidentally found carcinoma in situ, which contrasts with the results of prior studies.[2,7–14] This discrepancy may reflect

TABLE 2 Use of preoperative imaging before reduction mammaplasty for the overall cohort and for those with a newly diagnosed incidental cancer

	Total (*n*)	Mammography % (*n*)	Breast MRI (*n*)	Breast ultrasound % (*n*)	Any breast imaging % (*n*)
Overall cohort undergoing reduction mammaplasty					
Age (years)					
< 40	7410	18.4 (1363)	0.2 (14)	6.9 (513)	20.9 (1548)
40–44	2708	81.8 (2216)	0.9 (25)	16.3 (441)	82.6 (2237)
45–49	2618	84.2 (2204)	1.0 (26)	15.8 (414)	85.0 (2225)
50–54	2381	85.6 (2047)	0.8 (18)	13.6 (324)	86.8 (2067)
> 55	3852	83.3 (3209)	0.6 (24)	11.1 (426)	84.0 (3236)
Total	18969	58.2 (11040)	0.6 (106)	11.2 (2118)	59.6 (11311)
Cohort with new incidentally found breast cancer					
Age (years)					
<40	22	NR			NR
40–44	24	91.7 (22)	NR	NR	91.7 (22)
45–49	29	89.7 (26)			89.7 (26)
50–54	39	82.1 (32)			84.6 (33)
>55	72	77.7 (56)			79.2 (57)
Total	186	76.3 (142)			78.5 (146)

NR, not reported because the number was too small to report ($n < 10$)

TABLE 3 Locoregional and systemic treatment within 6 months after new breast cancer diagnosis

Treatment	New breast cancer (n = 120) % (n)
Reduction mammaplasty only	89.2 (107)
w/o radiation	85.0 (91)
With radiation	15.0 (16)
Reoperation mastectomy	10.8 (13)
Endocrine therapy	22.5 (27)

[a]Some patients received chemotherapy, but the number was too small to report ($n < 10$)

differences in data sources because many of these prior studies were performed through analysis of pathology reports at single-site institutions rather than through claims data in a national sample as in our study.

We also found that older age was associated with an increase in incidentally found breast cancer, which is consistent with the literature.[7]

The majority of women who underwent reduction mammoplasty had a preoperative mammogram (58.2%). This proportion increased only when women older than 40 years were considered (> 80%). This high rate of preoperative mammography for patients older than 40 years (> 80%) is consistent with the recommendations of a continuing education module from the American Society of Plastic Surgeons, which states that women older than 50 years and possibly women older than 40 years should have a preoperative mammogram before reduction mammaplasty.[16]

The current recommendations on the appropriate age to begin routine breast cancer screening remain controversial. The American Cancer Society and the American Society of Breast Surgeons recommend a discussion on mammography for women 40–44 years old, on annual screening for women 45–54 years old, and on annual or biennial screening for women 55 years of age or older.[17,18] The recommendations from the American Society of Plastic Surgeons continuing education module are more stringent than the recommendations for routine breast cancer screening due to the impact of reduction mammaplasty on future screening. Changes in the architecture of the breast and inability to undergo mammography for several months postoperatively are important considerations in the recommendation for preoperative breast imaging.[21,22] The perceived value of these factors are likely reflected in the high rate of preoperative imaging. It is important to note that all the patients in this study had health insurance, and our rates of preoperative mammography in this study therefore may be higher than would be found in a different population.

Although the rate of preoperative mammography is high, there is still room for improvement. Those 55 years of age or older who were incidentally found to have breast cancer had lower rates of preoperative mammography

(77.7%) than those 55 years of age or older in the entire cohort (83.3%), which may have left some cancers undetected that could have been detected preoperatively. However, most of the patients had received preoperative screening imaging as would be recommended by the American Society of Plastic Surgeons.

The majority of incidental breast cancers in our study were radiographically occult by screening mammogram. A preoperative mammogram had been performed for 76.3% of the women with breast cancer found incidentally. This is consistent with the findings of a smaller study by Waldner et al.[9] in 2018, which also reported several radiographically occult breast cancers found incidentally at reduction mammaplasty. In our study, few of the women underwent other types of preoperative breast imaging, including breast MRI or breast ultrasound. These imaging studies are likely used as needed based on individual histories and physical exam findings. It is important to note that the high proportion of radiographically occult cancers in our series should not be interpreted to mean that preoperative mammography is ineffective because our cohort selection would have excluded women found to have cancer on preoperative imaging. This represents a limitation of the Marketscan data and our study.

Most of the patients incidentally found to have incidental breast underwent no further treatment, both from locoregional and from systemic perspectives. Only 10.8% of the women underwent additional surgical procedures (10.8% had mastectomy and 0% had reoperative lumpectomy). The few studies examining treatment after incidental finding of breast cancer have reported a higher proportion of women undergoing subsequent mastectomy, ranging from 30 to 83%.[15,23–25] Consistent with our findings, these studies have demonstrated that reoperation lumpectomy is rare. Given that it is difficult to understand the orientation of the pathologic specimen, reoperation lumpectomy likely is not often feasible.[19,20] This highlights the importance of identifying breast cancer preoperatively so that breast-conserving surgery can be offered to the patient.

A possible reason for the low subsequent treatment rates observed in our study stems from a study limitation. Due to the nature of the ICD-9 codes, we were unable to differentiate between ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS). Given that our patient population was young, LCIS rather than breast cancer may have been identified at reduction mammaplasty, which would explain the lower treatment rates. In addition, because we could not exclude LCIS, our reported incidence of breast cancer found at the time of reduction mammaplasty likely is an overestimation. However, given our overall low rate, this would not change the conclusions of our study.

Although our use of a large claims database allowed us to capture a large cohort of patients who underwent reduction mammaplasty, our study had several other limitations. This database includes no Medicare fee-for-service claims. Although reduction mammoplasty is less frequent among older patients, some older patients who underwent reduction mammaplasty may have been excluded, so we could not extrapolate our results to this population. Nevertheless, other studies on reduction mammaplasty have shown a proportion of older patients similar to that shown in our study.[26,27] Also, the study population included only those who had insurance coverage for their reduction mammoplasty and not patients who may have paid out of pocket for the procedure. However, no evidence indicates that the incidence of occult cancer would differ for those without insurance coverage for reduction mammaplasty. Finally, we lacked oncologic information about the incidentally found breast cancers, including tumor size, margins, and receptor status, which limits the conclusions that can be drawn regarding appropriateness of observed treatment.

CONCLUSION

In a cohort of insured women undergoing reduction mammoplasty, incidental identification of breast cancer after reduction mammaplasty is rare. Our low reported rates may reflect the younger age of our study population. Importantly, incidentally found cancers may be radiographically occult. The findings of our study can be used to manage patient expectations of the potential for breast cancer identified incidentally at reduction mammaplasty, even with preoperative mammography, and to guide preoperative counseling discussions.

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DISCLOSURE The authors declare that they have no conflict of interest.

APPENDIX

See Table 4.

TABLE 4 ICD-9 and CPT codes used for procedure, diagnosis, imaging, and treatment definitions

	ICD-9	CPT
Reduction mammaplasty	85.31, 85.32	19318, 19318–50
Breast cancer	174.0–174.9, 233.0, V10.3	–
Obesity	278.00, 278.01, V85.30–V85.39, V85.41–V85.45	–
Family history of breast cancer	V16.3, V84.01	–
Mammography	87.37, V76.11, V76.12	77051–77052, 77055–77057, 77061–77063
Breast MRI	–	77058, 77059
Breast ultrasound		76641–76642, 76645
Lumpectomy	85.20, 85.21, 85.22, 85.23	19120, 19125, 19126, 19160, 19162, 19301, 19302
Mastectomy	85.33, 85.34, 85.36, 85.41–85.48, 85.35	19140, 19180, 19182, 19200, 19220, 19240, 19300, 19303–19307
Radiation	92.2–92.29, V58.0, V66.1, V67.1	77373, 77399, 77401–77404, 77406–77409, 77411–77414, 77416, 77418, 77385–77387, 77421–77425, 77427, 77431, 77432, 77435, 77469, 77470, 77499, 77520, 77522, 77523, 77525, 77750, 77761–77763, 77776–77778, 77781–77784, 77789, 77790, 77799
Chemotherapy	99.25, V58.1, V66.2, V67.2	96400–96402, 96405, 96406, 96408–96417, 96420, 96422, 96423, 96425, 96440, 96445, 96446, 96450, 96520–96523, 96530, 96542, 96545, 96549

ICD-9 international classification of diseases, 9th Revision, *CPT* current procedural terminology, *MRI* magnetic resonance imaging

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