

# Pathology Examination of Breast Reduction Specimens: Dispelling the Myth

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**Background:** More than 100,000 reduction mammoplasties are performed in the United States each year. There is large variance in reported incidence of cancerous/high-risk lesions, ranging from 0.06% to 4.6%. There has been debate whether histological review of breast reduction specimen is necessary. This study aimed to determine the incidence of cancerous/high-risk lesions and to evaluate risk factors for their occurrence.

**Methods:** A retrospective review was conducted for all patients who underwent reduction mammoplasty in 2018 by the senior author. Variables collected included demographics, comorbidities, history of breast surgery, family/personal history of breast cancer, weight of specimen, and pathologic findings. All specimens underwent pathologic evaluation and categorized as benign, proliferative, or malignant.

**Results:** A total of 155 patients underwent 310 reduction mammoplasties. Pathologic evaluations found that 11 patients (7.1%) had positive findings, 9 (5.8%) had proliferative lesions, and 2 (1.29%) had cancerous lesions. Patients with pathology were older ( $P = 0.038$ ), had a family history of breast cancer ( $P = 0.026$ ), and had a greater weight of resected tissue ( $P = 0.005$ ). Multivariable analysis showed family history of breast cancer ( $P = 0.001$ ), prior breast surgery ( $P = 0.026$ ), and greater weight of resected breast tissue ( $P = 0.008$ ) had a higher likelihood of positive pathology.

**Conclusions:** These findings demonstrate an incidence of positive pathology higher than that reported and illustrate the importance of histologic review of breast reduction specimens. Family history of breast cancer, prior breast surgery, and a greater weight of resected tissue increase risk for proliferative/cancerous lesions. (*Plast Reconstr Surg Glob Open* 2020;8:e3256; doi: [10.1097/GOX.0000000000003256](https://doi.org/10.1097/GOX.0000000000003256); Published online 20 November 2020.)

## INTRODUCTION

Reduction mammoplasty is considered the most effective treatment for symptomatic bilateral mammary hypertrophy. The American Society of Plastic Surgeons recorded

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a total of 101,126 breast reduction procedures in 2018, making it one of the most common procedures in plastic surgery.<sup>1</sup> This procedure has been shown to improve quality of life, including headaches, shoulder grooving, intertrigo, upper extremity numbness, and back pain,<sup>2,3</sup> in addition to psychological improvement in self-esteem.<sup>4,5</sup> Although the goals of breast reduction are the relief of symptoms of macromastia, it is imperative that surgeons understand the risk of incidental findings resulting from the resection and pathologic examination of breast tissue.<sup>6</sup>

The American Cancer Society estimates that there will be 276,480 new cases of invasive breast cancer in 2020<sup>7</sup> and recommends that women aged  $\geq 40$  years undergo annual screening.<sup>8</sup> Screening methods include mammography and clinical breast examination,<sup>9</sup> yet there is a risk of occult carcinoma even without radiological findings.<sup>10</sup> As such, pathological evaluation of breast reduction specimen is routinely performed to serve as a means of screening as well as random evaluation of occult breast cancer in the normal population.<sup>11,12</sup>

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Several studies have demonstrated the occurrence of cancerous and high-risk lesions in breast tissue removed during reduction mammoplasty, with the incidence of occult malignancy ranging from 0.06% to 4.6%.<sup>11,13-17</sup> A recent analysis found an incidence of invasive cancer or ductal carcinoma in situ (DCIS) in 2.3% of specimens and proliferative lesions in 13.8% of specimens.<sup>15</sup> These findings were also associated with older age, higher body mass index (BMI), and a history of cancer. Notably, there was no association between resection weight and the risk of proliferative lesions, which supports prior literature.<sup>18</sup> There is, however, support that breast volume is a risk factor for breast cancer recurrence and mortality.<sup>19,20</sup> In addition, one study reported that histological examination allowed for important diagnoses (DCIS, microinvasive malignancy, and lesions of uncertain malignant potential) in 2.1% of specimens who did not have gross abnormalities.<sup>21</sup> Another study determined that specimens of patients with prior contralateral breast cancer had a higher rate of occult malignancy than those with no history of breast cancer (5.5% versus 0.4%,  $P = 0.009$ ).<sup>22</sup>

Still, some argue that pathologic review of breast reduction specimens is unwarranted.<sup>23</sup> With a move to decrease unnecessary costs, evidence demonstrates that there is no need for pathologic review of all plastic surgical specimens (eg, nonbreast scar, keloid, implant, expander, capsule, and cartilage) and only selective submission should be implemented.<sup>24</sup> In addition, there is concern regarding inaccurate pathological results and prior literature suggests there was limited clinical use of histological evaluation with insufficient impact on patient care.<sup>25</sup>

The authors believe additional incidence data are necessary to make evidence-based decisions concerning this analysis. To help guide surgeons and dispel any arguments that exist, the authors performed a retrospective review of reduction mammoplasty specimens to determine the incidence of cancerous or high-risk lesions, evaluate their impact on patient care, and to ascertain risk factors for their occurrence.

## METHODS

### Data Collection

This study was performed in accordance with the Declaration of Helsinki. All patients who underwent reduction mammoplasty in 2018 by the senior author (SG) were included in the study. A total of 155 patients were identified. Exclusion criteria included a lack of follow-up documentation and male gender ( $n = 1$ ). All patients aged 35 years and older underwent preoperative mammogram and further ultrasound evaluation if indicated. Variables collected included patient demographics, comorbidities, history of prior breast surgery, family history of breast cancer, weight of breast specimen, and pathologic findings. All patients underwent pathologic evaluation of their specimens. Pathologists performed 1-cm cuts for gross inspection regardless of specimen size. Glandular tissue was then examined microscopically to identify disease. The pathologic evaluation was categorized as benign, proliferative (hyperplasia, atypical ductal hyperplasia,

**Table 1. Classification of Pathological Findings**

Benign
Proliferative
Hyperplasia
Atypical ductal hyperplasia
Atypical lobular hyperplasia
Lobular carcinoma in situ
Malignant
Invasive carcinoma
Ductal carcinoma in situ

atypical lobular hyperplasia, or lobular carcinoma in situ), or malignant (invasive carcinoma and ductal carcinoma in situ) (Table 1). The most advanced lesion was considered for breasts with multiple and various proliferative lesions.

The primary outcome measure was the incidence of carcinoma or high-risk lesions in reduction mammoplasty specimens. The secondary outcome was the need for intervention secondary to the pathological findings.

### Statistical Analysis

Statistical analyses were performed with the Independent Student *t*-test or Fisher Exact test to analyze the significant differences in patient characteristics. Multivariate logistic regression analysis was used to identify independent predictive factors for benign and proliferative/cancerous lesions among the patient population. Data analyses were performed using SPSS (version 25.0) for Windows (IBM, Armonk, N.Y., USA).  $P < 0.05$  was considered significant.

## RESULTS

A total of 155 unique patients underwent reduction mammoplasty of 310 breasts between January 1, 2018 and December 31, 2018 (Table 2). The mean age and BMI were 38.1 years and 30.50 kg/m<sup>2</sup>, respectively. Eleven patients (7.1%) were found to have positive pathological findings. There were 9 patients (5.8%) with proliferative lesions and 2 patients (1.29%) with cancerous lesions. The rate of pathological findings for the number of breasts was 4.19%, with proliferative lesions found in 11 breasts (3.55%) and cancerous lesions found in 2 breasts (0.65%) (Table 3).

Patients with positive pathology were significantly older ( $P = 0.038$ ), had a family history of breast cancer ( $P = 0.026$ ), and had a greater weight of resected breast tissue than patients with benign pathologic findings (1050.72 g versus 681.20 g,  $P = 0.005$ ). There was no significant difference between BMI ( $P = 0.168$ ), history of diabetes ( $P = 0.125$ ), hypertension ( $P = 0.407$ ), smoking ( $P = 1$ ), breast cancer ( $P = 1$ ), and prior breast surgery ( $P = 0.257$ ) between the 2 groups.

The multivariable logistic regression analysis model was statistically significant ( $\chi^2 (8) = 25.86$ ,  $P < 0.001$ ), explaining 39% (Nagelkerke  $R^2$ ) of the variance in the classification of pathology, and correctly classified 92% of cases. Family history of breast cancer (OR, 95.349; 95% CI, 5.728–1587.224;  $P = 0.001$ ), prior breast surgery (OR, 32.384; 95% CI, 1.519–690.354;  $P = 0.026$ ), and a greater weight of resected breast tissue (OR, 1.003; 95% CI, 1.001–1.005;  $P = 0.008$ ) were independent predictors of proliferative and/or cancerous lesions. There was a trend toward

**Table 2. Patient Demographics**

	Benign	Proliferative Lesions/ Precancerous/Cancer	P
No. patients	144	11	N/A
No. breasts	297	13	N/A
Mean age ± SD (y)	37.47 ± 13.52	46.27 ± 12.75	0.038
Mean BMI ± SD (kg/m <sup>2</sup> )	30.35 ± 4.56	32.36 ± 5.48	0.168
Diabetes	7 (4.86 %)	2 (18.18 %)	0.125
Hypertension	24 (16.67 %)	3 (27.27 %)	0.407
Smoking	8 (5.56 %)	0	1
History of breast cancer	0	0	1
Family history of breast cancer	2 (1.39 %)	2 (18.18 %)	0.026
Prior breast surgery	3 (2.08 %)	1 (9.09 %)	0.257
Mean weight of resected breast specimen ± SD (g)	681.20 ± 389.36	1050.72 ± 652.62	0.005

All statistical analysis was performed for number of patients, not number of breasts.  
N/A, not applicable.

age (OR, 1.048; 95% CI, 0.985–1.114;  $P = 0.14$ ) and diabetes (OR, 9.176; 95% CI, 0.618–136.314;  $P = 0.107$ ) as risk factors, but they were not statistically significant (Table 4).

Of the 11 patients with positive findings, 2 had DCIS, 5 had lobular carcinoma in situ, 3 had atypical ductal hyperplasia, and 1 had atypical lobular hyperplasia (Table 5). All patients were referred to surgical oncology. One patient with DCIS was scheduled for additional oncoplastic breast reduction. Three patients (27%) were treated with hormone therapy and five patients (45%) were managed with continued surveillance. Three patients were lost to follow-up but were verified to have sought oncologic treatment outside of our facility. Overall, 3 (27%) patients with positive pathology underwent change in management. Although one might argue that all patient management was changed because all patients were planned for significantly more frequent radiographic screening.

## DISCUSSION

Pathologic review of reduction mammoplasty specimens enables identification of occult malignancy or high-risk lesions. Given the costs associated with routine

**Table 3. Rate of Lesions on Pathologic Evaluation**

	No. Patients (%)	No. Breasts (%)
Total rate of pathological findings	11 (7.09 %)	13 (4.19 %)
Proliferative lesions	9 (5.8 %)	11 (3.55 %)
Atypical ductal hyperplasia	3 (1.94 %)	3 (0.96 %)
Atypical lobular hyperplasia	1 (0.65 %)	1 (0.32 %)
Lobular carcinoma in situ	5 (3.23 %)	7 (2.26 %)
Cancer lesions		
Ductal carcinoma in situ	2 (1.29 %)	2 (0.65 %)

**Table 4. Multivariable Logistic Regression Analysis for Proliferative/Cancerous Lesions**

Predictor value	B (SE)	Wald	OR (95% CI)	P
Age	0.05 (0.03)	2.182	1.048 (0.985–1.114)	0.14
BMI	−0.13 (0.12)	1.211	0.878 (0.697–1.107)	0.271
Diabetes	2.23 (1.38)	2.592	9.176 (0.618–136.314)	0.107
Hypertension	−0.81 (1.03)	0.615	0.447 (0.06–3.342)	0.433
Smoking	−18.05 (14336.22)	0	0 (0)	0.999
Family history of breast cancer	4.56 (1.44)	10.089	95.349 (5.728–1587.224)	0.001
Prior breast surgery	3.48 (1.56)	4.963	32.384 (1.519–690.354)	0.026
Mean weight of resected breast specimen (g)	0.003 (0.001)	7.104	1.003 (1.001–1.005)	0.008

Nagelkerke  $R^2 = 0.390$ . Model  $\chi^2 (8) = 25.86$ ,  $P < 0.001$ .

pathologic analysis and risks for false positives, there must be proper justification for submitting each case for pathology.<sup>24</sup> There have been varied reports of incidence of positive finds in the literature and questions still remain with regard to the utility of submitting all specimens. In this retrospective study, the authors found evidence supporting the histologic examination of specimen for this procedure. In particular, several risk factors such as age, family history, and weight of tissue offered greater associations with positive pathology. Because of the lack of agreement with regard to the need for pathology, some pathologists may only complete gross or limited microscopic examinations on specimen and therefore the yield of positive specimen may actually be higher.

The findings of this study are consistent with previously published data. In one such study, the authors found a 0.2% risk of cancerous lesions and a 1.9% risk of atypical ductal hyperplasia and flat epithelial atypia.<sup>13</sup>

**Table 5. Outcomes of Positive Pathological Lesions**

Patient No.	Findings	Results
1	Lobular carcinoma in situ	Lost to follow-up
2	High grade ductal carcinoma in situ	Lost to follow-up
3	Atypical ductal hyperplasia	Surveillance
4	Lobular carcinoma in situ	Surveillance
5	Ductal carcinoma in situ	Oncoplastic breast reduction, hormonal therapy
6	Atypical ductal hyperplasia	Hormonal therapy
7	Atypical lobular hyperplasia	Hormonal therapy
8	Atypical ductal hyperplasia	Lost to follow-up
9	Lobular carcinoma in situ	Surveillance
10	Lobular carcinoma in situ, bilateral	Surveillance
11	Lobular carcinoma in situ, bilateral	Surveillance

Similarly, another study reported a 0.31% risk of invasive carcinoma and a 6.26% risk of benign high-risk lesions.<sup>11</sup> Because of the significant clinical findings in our review as well as prior findings, the authors conclude that routine submission of specimen for pathologic analysis is justified and presumably beneficial to those with positive findings. In our population, 27.3% of patients underwent a change in management due to the findings discovered on pathology. These results demonstrate that submitting breast reduction specimens to pathology is clinically important and may affect management. Obviously, longer follow-up might demonstrate that a greater number of patients eventually had their management affected during the ensuing years due to their increased surveillance.

We identified that having risk factors of family history of breast cancer, prior breast surgery, and greater weight of resected breast tissue were predictive factors of positive pathology, while age was associated with a greater incidence. Although we did not find a statistically significant difference in the incidence of positive pathology in patients who had prior breast surgery, multivariate analysis demonstrated that prior breast surgery has a prospective influence on the discovery of positive pathology. Several of these factors have been investigated previously. In an analysis of the management of breast cancer detection in reduction mammoplasty, one study described the strong association between age and incidence of occult breast cancer, as well as personal history, family history, and previous breast biopsy showing high-risk pathology.<sup>17</sup> In addition, another analysis found that positive pathology was associated with older age, higher BMI, and history of cancer.<sup>15</sup> Even though our data did not show that history of breast cancer was statistically significant, likely since our patient population is younger, other papers have shown breast cancer as a risk factor for positive pathology in breast reduction. We also report a positive association between greater resection weight and positive pathology, while prior studies have examined this issue and found no relationship.<sup>14,15</sup> It is therefore particularly important for patients with larger breasts to have their pathology analyzed more carefully as they will likely have larger resection weights with a greater propensity to contain positive pathology. The authors believe that patients with these risk factors should be monitored with greater detail as they have a considerable risk for positive findings.

Our results substantiate the use of pathologic review of all breast specimens and confirm that gross evaluation is not sufficient for identification of occult lesions, in particular for patients with the aforementioned risk factors. The patients with positive pathology results underwent treatment for their respective diagnoses. Of the 11 patients with positive findings, all were referred to a surgical oncologist for further evaluation. Of those, surveillance was the most common course of action, followed by hormonal therapy. This is in contrast to the results of another study, where hormonal therapy was the most common for proliferative lesions.<sup>15</sup> Additional surgical intervention was the lowest rate of management. Without pathologic analysis, occult malignancy would not have been identified and these patients would have been at a significantly higher risk for invasive cancer.

There are several limitations to this study. All patients are from a single provider, which may have limited the variability of the population under examination. The average age of the patient population in this study indicates a relatively younger population. This influences the prevalence of a medical history and consequently its predictive value for positive pathology. A randomized, prospective study with longer follow-up could potentially answer many of the outstanding issues. However, given these findings, it might be considered unethical to not do a pathologic examination for all patients.

## CONCLUSIONS

Pathological review of breast specimens following reduction mammoplasty is currently an area of debate and controversy. In reality though, cost is probably the only limiting factor. The results of this study reveal that the incidence of positive pathology is higher than previously reported, which demonstrates the importance of careful histologic review of breast reduction specimens. Those with a family history of breast cancer, prior breast surgery, and a greater weight of resected breast tissue seem to demonstrate a greater risk for proliferative or cancerous lesions. Our results provide evidence that a more detailed histologic evaluation of breast specimens is necessary and warranted, especially in high-risk patients.

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## REFERENCES

1. American Society of Plastic Surgeons. 2018 Plastic Surgery Statistics. Available at: <https://www.plasticsurgery.org/news/plastic-surgery-statistics>. Accessed December 23, 2019.
2. Bayramçılı M, Sirinoglu H, Yalçın D. Outcome after breast reduction considering body mass index and resection amount. *Aesthet Surg J*. 2017;37:1103–1110.
3. Chao JD, Memmel HC, Redding JF, et al. Reduction mammoplasty is a functional operation, improving quality of life in symptomatic women: A prospective, single-center breast reduction outcome study. *Plast Reconstr Surg*. 2002;110:1644–52; discussion 1653.
4. Collins ED, Kerrigan CL, Kim M, et al. The effectiveness of surgical and nonsurgical interventions in relieving the symptoms of macromastia. *Plast Reconstr Surg*. 2002;109:1556–1566.
5. Pérez-Panzano E, Gascón-Catalán A, Sousa-Domínguez R, et al. Reduction mammoplasty improves levels of anxiety, depression and body image satisfaction in patients with symptomatic macromastia in the short and long term. *J Psychosom Obstet Gynaecol*. 2017;38:268–275.
6. Breiting LB, Henriksen TF, Kallialis LV, et al. A prospective study of short- and long-term cosmetic outcome after reduction mammoplasty from three different perspectives: The patient, a department surgeon, and an independent private practitioner in plastic surgery. *Plast Reconstr Surg*. 2012;130:273–281.
7. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin*. 2020;70:7–30.
8. American Cancer Society. Breast Cancer Facts & Figures 2019–2020. Available at: <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/breast-cancer-facts-and-figures/breast-cancer-facts-and-figures-2019-2020.pdf>. Accessed January 18, 2020.

9. American Cancer Society. Global Cancer Facts & Figures 4th Edition. Available at: <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/global-cancer-facts-and-figures/global-cancer-facts-and-figures-4th-edition.pdf>. Accessed January 18, 2020.
10. Celik B, Senen Demiroz D, Yaz M, et al. Radiologically innocuous breast reduction specimens. Should we send them to pathology lab anyway? *G Chir*. 2013;34:302–306.
11. Acevedo F, Armengol VD, Deng Z, et al. Pathologic findings in reduction mammoplasty specimens: A surrogate for the population prevalence of breast cancer and high-risk lesions. *Breast Cancer Res Treat*. 2019;173:201–207.
12. Degnim AC, Visscher DW, Hoskin TL, et al. Histologic findings in normal breast tissues: Comparison to reduction mammoplasty and benign breast disease tissues. *Breast Cancer Res Treat*. 2012;133:169–177.
13. Desouki MM, Li Z, Hameed O, et al. Incidental atypical proliferative lesions in reduction mammoplasty specimens: Analysis of 2498 cases from 2 tertiary women's health centers. *Hum Pathol*. 2013;44:1877–1881.
14. Ambaye AB, Goodwin AJ, MacLennan SE, et al. Recommendations for pathologic evaluation of reduction mammoplasty specimens: A prospective study with systematic tissue sampling. *Arch Pathol Lab Med*. 2017;141:1523–1528.
15. Mastroianni M, Lin A, Hughes K, et al. Proliferative lesions found at reduction mammoplasty: Incidence and implications in 995 breast reductions. *Plast Reconstr Surg*. 2019;143:271e–275e.
16. Akintayo RM, Rosenkranz KM, Wells WA, et al. Reviewing the evidence to guide clinical care: Proliferative breast lesions in breast reduction specimens. *Ann Plast Surg*. 2017;79:410–414.
17. Carlson GW. The management of breast cancer detected by reduction mammoplasty. *Clin Plast Surg*. 2016;43:341–347.
18. Hsieh CC, Trichopoulos D. Breast size, handedness and breast cancer risk. *Eur J Cancer*. 1991;27:131–135.
19. Wisse A, Tryggvadottir H, Simonsson M, et al. Increasing pre-operative body size in breast cancer patients between 2002 and 2016: Implications for prognosis. *Cancer Causes Control*. 2018;29:643–656.
20. Williams PT. Breast cancer mortality vs. exercise and breast size in runners and walkers. *PLoS One*. 2013;8:e80616.
21. Cook IS, Fuller CE. Does histopathological examination of breast reduction specimens affect patient management and clinical follow up? *J Clin Pathol*. 2004;57:286–289.
22. Tadler M, Vlastos G, Pelte MF, et al. Breast lesions in reduction mammoplasty specimens: A histopathological pattern in 534 patients. *Br J Cancer*. 2014;110:788–791.
23. Zambacos GJ. Commentary on: Is histological evaluation of reduction mammoplasty specimens worthwhile? *Aesthet Surg J*. 2019;39:NP185–NP188.
24. Fisher M, Alba B, Bhuiya T, et al. Routine pathologic evaluation of plastic surgery specimens: Are we wasting time and money? *Plast Reconstr Surg*. 2018;141:812–816.
25. The Royal College of Pathologists. *Histopathology and Cryopathology of Limited or No Clinical Value*. London: RCPATH publication; 2002.