

The Effects of the COVID-19 Pandemic on Mastectomy Outcomes for Breast Cancer

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Abstract

Many patients with breast cancer had surgical procedures postponed or modified in 2020 due to the COVID-19 pandemic. Using the ACS NSQIP database, we the clinical outcomes of breast cancer patients who did undergo mastectomies in 2020. The ongoing surgical services and mastectomies for breast cancer during the pandemic produced similar clinical outcomes to those seen in 2019.

Background: Single center studies have shown that during the Coronavirus Disease 2019 (COVID-19) pandemic, many patients had surgical procedures postponed or modified. We studied how the pandemic affected the clinical outcomes of breast cancer patients who underwent mastectomies in 2020. **Methods:** Using the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database, we compared clinical variables of 31,123 and 28,680 breast cancer patients who underwent a mastectomy in 2019 and 2020, respectively. Data from 2019 served as the control, and data from 2020 represented the COVID-19 cohort. **Results:** Fewer surgeries of all kinds were performed in the COVID-19 year than in the control (902,968 vs. 1,076,411). The proportion of mastectomies performed in the COVID-19 cohort was greater than in the control year (3.18% vs. 2.89%, $P < 0.001$). More patients presented with ASA level 3 in the COVID-19 year vs. the control ($P < .002$). Additionally, the proportion of patients with disseminated cancer was lower during the COVID-19 year ($P < .001$). Average hospital length of stay ($P < .001$) and time from operation to discharge were shorter in the COVID vs. control cohort ($P < .001$). Fewer unplanned readmissions were seen in the COVID year ($P < .004$). **Conclusion:** The ongoing surgical services and mastectomies for breast cancer during the pandemic produced similar clinical outcomes to those seen in 2019. Prioritization of resources for sicker patients and the use of alternative interventions produced similar results for breast cancer patients who underwent a mastectomy in 2020.

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Introduction

On March 11, 2020, the outbreak of Coronavirus Disease 2019 (COVID-19) was declared a pandemic by the World Health Organization. In the following months, key hospital resources such as intensive care unit beds and mechanical ventilators were reallocated to mitigate strain on the healthcare system.^{1,2} As these services were stretched thin, providers had to make difficult decisions to deploy them in such a way as to provide the most benefit to the population.³ Physicians from Fox Chase Cancer Center anticipated that the use of cancer care resources would be in direct conflict with the growing needs of COVID-19 patients, referring to cancer care during the pandemic as “a war on 2 fronts”.⁴

Early research provided evidence that cancer patients are more susceptible to COVID-19 infection, morbidity, and mortality.^{5,6} Patients in general were wary of presenting to the ER or clinics for new or existing medical issues during the pandemic, for fear of contracting the virus.⁷ As a result, physicians had to carefully weigh the benefit of bringing cancer patients into a clinical environment against the potential risk of spreading COVID-19 among an already vulnerable population.

Breast cancer patients, who make up the highest proportion of cancer patients worldwide,⁸ were similarly affected.⁹ For example, Yin et al. reported that from March 15th to April 5th of 2020, the average rate of surgical breast consultations declined by 20.5% weekly.¹⁰ Additionally, the number of breast imagings performed declined by an average of 61.7% weekly in the same time period. Decreased utilization of health services by patients during the pandemic may be partially to blame,¹¹ but physician-directed initiatives also impacted treatment. The American College of Surgeons provided guidelines on how essential cancer surgeries should be maintained during the pandemic, which prioritized operations for

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Table 1 Patient Demographics

Factors	2019 (n = 31,123)		2020 (n = 28,680)		P- value
	Count	%	Count	%	
White	20306	65.24%	17972	62.66%	<.001
Black/African American	3028	9.73%	3240	11.30%	<.001
Asian	1709	5.49%	1653	5.76%	.148
American Indian or Alaska Native	154	0.49%	118	0.41%	.13
Native Hawaiian or Pacific Islander	103	0.33%	113	0.39%	.199
Hispanic	2089	6.71%	2185	7.62%	<.001
Age (y) ± SEM	60.6 ± 0.074		60.0 ± 0.078		<.001
BMI (kg/m ²) ± SEM	29.62 ± 0.04		29.51 ± 0.04		.05

patients “likely to have survivorship compromised if surgery not performed within next 3 months”.¹² In a mixed-methods study, researchers at the University of Colorado School of Medicine found that breast cancer patients were anxious about contracting COVID-19 and how their care might be affected by deferrals or other treatment modifications.¹³

Now that the brunt of the healthcare challenges brought upon us by the COVID-19 pandemic seems to have subsided, the implications of these trends have yet to be fully investigated. This led us to analyze data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) in order to elucidate the downstream effects of the COVID-19 pandemic on breast cancer patients who underwent a mastectomy.

Methods

Using the ACS NSQIP database, we analyzed differences in patient demographics, preoperative comorbidities, perioperative factors, and postoperative complications between breast cancer patients in 2019 and 2020. CPT codes 19301, 19302, 19303, 19304, 19305, 19306, and 19307, and ICD-10 codes C50 and D05 were used to select for patients who underwent mastectomies for breast cancer.¹⁴ The Chi-square test was used to analyze categorical variables, like comorbidities, and Student's t-tests for continuous parameters, such as age and body mass index (BMI). Normality for conducting Student's t- tests on continuous variables was confirmed visually by use of histograms. The statistical software Minitab (version 17.1.0) was used for these analyses. All terms and definitions found in this study referring to gender, race, or ethnicity were adopted from the terms outlined and defined in the ACS NSQIP Participant Use File (PUF) Data Guide.¹⁵ Given the retrospective nature of the deidentified data used, institutional review board permission was not required.

Results

In 2019, a total of 31,123 patients received a mastectomy, compared to 28,680 patients in 2020 (Table 1). In absolute numbers, fewer surgical cases of any kind were performed in the COVID year than in the control (902,968 vs. 1,076,411). However, the proportion of patients who underwent a mastectomy in the COVID cohort was greater than in the control (3.18% vs. 2.89%, $P < .001$). Additionally, a greater proportion of patients in the

COVID cohort also underwent reconstructive surgery following the primary mastectomy or lumpectomy (23.9% vs. 20.3%, $P < .001$).

There were less White patients (62.66% vs. 65.24%) and more Black patients (11.30% vs. 9.73%) who received a mastectomy in 2020 compared to 2019 ($P < .001$). There was also a larger proportion of Hispanic patients in 2020 compared to the previous year (7.62% vs. 6.71%, $P < .001$). Patients, on average, were younger ($P < .001$) and had lower BMIs ($P = .05$) in 2020.

Patients were less likely to present with disseminated cancer (1.71% vs. 2.47%, $P < .001$), dyspnea (4.24% vs. 5.17%, $P < .001$), or COPD (2.45% vs. 2.77%, $P = .016$) in 2020. However, compared to 2019, patients were more likely to have systemic inflammatory response syndrome (SIRS, 0.34% vs. 0.25%, $P = .033$) prior to the operation (Table 2). The statistical difference seen here is due to the large population studied and may not be clinically significant.

In 2020, a smaller proportion of patients were classified as ASA class 1 (3.12% vs. 3.47%, $P = .018$) or ASA class 2 (54.36% vs. 55.40%, $P = .011$), and a significantly higher percentage of patients were classified under ASA class 3 (40.63% vs. 39.40%, $P = .002$) than in 2019 (Table 3). Furthermore, both the average length of stay and time from operation to discharge were found to be significantly shorter in 2020 ($P < .001$).

Postoperative complication rates were very similar between the 2 years, with the exception being that there was a lower rate of unplanned readmissions in 2020 (2.15% vs. 2.51%, $P = .004$) (Table 4).

Discussion

The overall smaller number of patients who underwent a mastectomy in 2020 compared to 2019 is not surprising given the circumstances, which can also explain the relatively higher proportion of mastectomies performed in 2020: the patients undergoing operations were those for whom it was deemed medically necessary in the near future, and they were prioritized. As to why these patients were also more likely to undergo reconstructive surgery following the initial operation, a study of mastectomy and lumpectomy rates suggest this is due to the psychological importance of reconstruction, especially in double mastectomy patients, and the desire to reduce a backlog of future reconstruction cases during the pandemic.¹⁶ It is therefore probable that reconstruction was

Table 2 Preoperative Comorbidities

Factors	2019 (n = 31,123)		2020 (n = 28,680)		P-value
	Count	%	Count	%	
Diabetes	4302	13.82%	3886	13.55%	.332
Dyspnea	1608	5.17%	1217	4.24%	<.001
Ventilator dependent	3	0.01%	3	0.01%	1
COPD	862	2.77%	704	2.45%	.016
Ascites	6	0.02%	5	0.02%	1
CHF	117	0.38%	112	0.39%	.773
Hypertension requiring medication	13014	41.81%	11897	41.48%	.409
Acute renal failure	18	0.06%	11	0.04%	.28
Dialysis	77	0.25%	73	0.25%	.862
Disseminated cancer	770	2.47%	491	1.71%	<.001
Open wound/Wound infection	101	0.32%	87	0.30%	.644
Weight loss	145	0.47%	114	0.40%	.192
Bleeding disorder	430	1.38%	367	1.28%	.277
Pre-operative transfusion	17	0.05%	14	0.05%	.755
Sepsis	3	0.01%	3	0.01%	1
Septic shock	1	0.00%	1	0.00%	1

Table 3 Perioperative Factors

Factors	2019 (n = 31,123)		2020 (n = 28,680)		P-value
	Count	%	Count	%	
ASA 1	1079	3.47%	895	3.12%	.018
ASA 2	17243	55.40%	15591	54.36%	.011
ASA 3	12263	39.40%	11653	40.63%	.002
ASA 4	505	1.62%	513	1.79%	.117
ASA 5	0	0.00%	2	0.01%	.23
Wound class: clean	30427	97.76%	28041	97.77%	.946
Wound class: clean/contaminated	502	1.61%	438	1.53%	.4
Wound class: contaminated	166	0.53%	163	0.57%	.564
Wound class: dirty/infected	28	0.09%	38	0.13%	.118
Breast reconstruction	6315	20.3%	6857	23.9%	<.001
Time from operation to discharge (d)	0.71 ± 0.007		0.57 ± 0.007		<.001
Length of stay (d)	0.76 ± 0.01		0.62 ± .011		<.001

performed as part of the same procedure when appropriate, to reduce subsequent visits and therefore exposure risk. For patients with less surgically urgent cases, many oncologists recommended the postponing of surgical intervention.^{17,18} A study by Satish et al. found that nearly half of COVID-negative, lower-risk breast cancer patients had their treatment(s) postponed or modified during the first year of the pandemic.

Postponing of surgical treatments, however, did not necessarily mean a lack of treatment entirely thanks to outpatient therapies. For example, some patients may have undergone intraoperative radiation therapy to buy time before surgical intervention.¹⁹ Furthermore, patients with hormone receptor positive breast cancer may have elected to receive neoadjuvant endocrine therapy to accomplish the same result.^{20,21} These alternatives could be performed at

smaller facilities, the latter even at a primary care location. However, the outcomes of these patients were not examined in this study as we focused on mastectomies only.

The reduced proportion of patients presenting with COPD or dyspnea prior to operation was also not surprising, given that respiratory conditions result in increased vulnerability to and a worse prognosis if infected with COVID-19 in the hospital environment.²² Respiratory and cardiac comorbidities likely resulted in postponement of surgery for these patients if their cancer was not life-threatening in the short term. Our finding of a decrease in the rate of patients with disseminated cancer could also be explained by preferential use of non-surgical management as the first choice during this time. Alternatively, it is possible that small malignancies confirmed by mammogram were treated in an outpa-

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Table 4 Postoperative Complications

Factors	2019 (n = 31,123)		2020 (n = 28,680)		P-value
	Count	%	Count	%	
Mortality	14	0.04%	13	0.05%	.984
Superficial incisional SSI	873	2.80%	781	2.72%	.542
Deep incisional SSI	124	0.40%	110	0.38%	.771
Organ/space SSI	254	0.82%	261	0.91%	.214
Wound disruption	137	0.44%	112	0.39%	.346
Pneumonia	22	0.07%	31	0.11%	.125
Unplanned intubation	13	0.04%	10	0.03%	.667
Pulmonary embolism	40	0.13%	31	0.11%	.468
On ventilator > 48 h	6	0.02%	4	0.01%	.756
Progressive renal insufficiency	10	0.03%	7	0.02%	.576
Acute renal failure	2	0.01%	3	0.01%	.676
UTI	118	0.38%	87	0.30%	.113
CVA/Stroke	11	0.04%	16	0.06%	.24
Cardiac arrest requiring CPR	9	0.03%	4	0.01%	.272
Myocardial infarction	16	0.05%	17	0.06%	.682
Bleeding	239	0.77%	233	0.81%	.539
DVT requiring therapy	45	0.14%	38	0.13%	.692
Sepsis	78	0.25%	65	0.23%	.549
Septic shock	7	0.02%	3	0.01%	.348
Return to OR	1032	3.32%	962	3.35%	.794
In hospital > 30 d	7	0.02%	2	0.01%	.183
Unplanned readmission	780	2.51%	618	2.15%	.004
CDI	19	0.06%	9	0.03%	.094
Number of patients with 1 or more of the above complications	2642	8.49%	2329	8.12%	.103

tient care setting without subsequent whole-body scans.²³ This also agrees with literature findings which cite decreased radiology volume during the first stages of the pandemic.^{24,25}

Those patients who did undergo a mastectomy in 2020 had significantly shorter lengths of stay and time from operation to discharge and were also less likely to have an unplanned readmission. We speculate that providers and facilities were more aware of the time patients spent in a medical environment, which in the context of COVID-19 meant increased risk of transmission, for patient safety purposes and possibly due to pandemic guidelines. Interestingly, all other postoperative complication rates were similar to those reported in 2019. Facilities were able to reduce the time that the patient was in a hospital environment, while maintaining or even possibly improving standards and outcomes of care, as evidenced by our analysis. Despite this, a collaborative simulation model experiment predicted a resulting 2,487 (0.52% increase) breast cancer deaths by 2030 due to delayed screening, diagnosis, and treatment during the COVID-19 pandemic.²⁶

This study reports outcomes on patients who were able to receive surgical treatment during the pandemic but is primarily limited in that we do not have outcome data on patients whose treatment was postponed beyond 2020. The retrospective nature of this study also prevented us from choosing to analyze more specific outcome variables and other clinical parameters in this population,

in addition to more subjective information, such as patient experience. More studies are needed to determine the full effects of the COVID-19 pandemic on breast cancer patients and other cancer patients as well.

Overall, the ongoing surgical services and mastectomies for breast cancer during the pandemic produced very similar results to what were seen in 2019. Prioritization of resources for sicker patients with breast cancer and the use of alternative interventions produced similar results for breast cancer patients who underwent mastectomies during the first year of the pandemic. The effects of delayed surgical treatment, however, are not fully clear at this point in time and require further investigation.

Clinical Practice Points

- Single center studies have shown that during the Coronavirus Disease 2019 (COVID-19) pandemic, many non-critical patients had surgical treatment delayed due to pandemic-related safety measures and reallocation of hospital resources. Therefore, we used the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database to compare clinical factors of 31,123 and 28,680 breast cancer patients who underwent a mastectomy for breast cancer in 2019 (Control group) and in 2020 (COVID-19 group) respectively.

- In 2020, the pre-operative conditions of patients who underwent a mastectomy for cancer were more severe than those in the 2019 cohort.

Even so, the outcomes of mastectomy patients were slightly better in 2020, indicating that hospitals provided excellent care for these patients even during the pandemic.

With this hindsight, we now see that healthcare institutions were able to maintain a high standard of care for patients with breast cancer, which can inform future care decisions should a similar crisis arise.

Declaration of Competing Interest

The authors declare no conflict(s) of interest, financial or otherwise.

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