



Published in final edited form as:

J Surg Oncol. 2023 October ; 128(5): 726–742. doi:10.1002/jso.27378.

Decreasing Length of Stay in Breast Reconstruction Patients: A National Analysis of 2019–2020

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Abstract

Background: The effects of COVID-19 on breast reconstruction included shifts towards alloplastic reconstruction methods to preserve hospital resources and minimize COVID exposures. We examined the effects of COVID-19 on breast reconstruction hospital length of stay (LOS) and subsequent early postoperative complication rates.

Methods: Using the National Surgical Quality Improvement Program (NSQIP), we examined female patients who underwent mastectomy with immediate breast reconstruction from 2019–2020. We compared postoperative complications across 2019–2020 for alloplastic and autologous reconstruction patients. We further performed sub-analysis of 2020 patients based on LOS.

Results: Both alloplastic and autologous reconstruction patients had shorter inpatient stays. Regarding the alloplastic 2019 versus 2020 cohorts, complication rates did not differ ($p > 0.05$ in all cases). Alloplastic patients in 2020 with longer LOS had more unplanned reoperations ($p < 0.001$). Regarding autologous patients in 2019 versus 2020, the only complication increasing from 2019 to 2020 was deep SSI (2.0% vs 3.6%, $p = 0.024$). Autologous patients in 2020 with longer LOS had more unplanned reoperations ($p = 0.007$).

Conclusions: In 2020, hospital LOS decreased for all breast reconstruction patients with no complication differences in alloplastic patients and a slight increase in SSIs in autologous patients. Shorter LOS may lead to improved satisfaction and lower healthcare costs with low complication risk, and future research should examine the potential relationship between LOS and these outcomes.

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Financial Disclosure: None of the authors have a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

Keywords

tissue expander; direct-to-implant; autologous; length of stay

INTRODUCTION

The COVID-19 pandemic dramatically altered practices in oncologic breast surgery and reconstruction in 2020. In our prior study, we demonstrated that while breast reconstruction rates did not change, alloplastic reconstruction increased and autologous reconstruction decreased during that year.^[1] We also demonstrated that outpatient alloplastic breast reconstruction rates increased and length of stay (LOS) decreased significantly for all methods of breast reconstruction. These changes were likely in response to preserving hospital resources and decreasing patient exposure to COVID-19.^[2–8]

Given that there was a significant decrease in in-hospital LOS for all methods of breast reconstruction on a national level, the COVID-19 pandemic provided an unprecedented lens to assess the impact of early discharge on complication rates after breast reconstruction. General surgery and orthopedic studies using national databases have examined the effects of COVID-19 on early post-surgical complications, often finding no major difference from pre-pandemic complication rates.^[9, 10] Nonetheless, the tendency toward shorter LOS could feasibly impact clinical outcomes in breast reconstructive surgery, especially given the unique challenges of many breast reconstruction patients who undergo radiation and chemotherapy.^[11, 12]

While our prior study showed an overall decreased LOS for alloplastic and autologous breast reconstruction during the COVID-19 pandemic, the aim of this study is to compare early postoperative complication rates and readmissions in 2019 versus 2020 to assess whether complication rates changed concurrent to a decrease in LOS. A secondary aim is to assess differences in demographics, comorbidities, and postoperative complications in patients with shorter versus longer LOS. We hypothesize that, despite a decrease in overall hospitalization time for all breast reconstruction procedures, complication rates did not significantly differ between 2019 and 2020.

METHODS

We used data acquired from the American College of Surgeons' National Surgical Quality Improvement Program (NSQIP) to examine female patients (> 18 years of age) who underwent mastectomy with immediate breast reconstruction from 2019–2020. NSQIP is an outcomes-based national database that reports 30-day morbidity and mortality outcomes for all major inpatient and outpatient surgical procedures.^[13] We used CPT codes for mastectomy with immediate breast reconstruction.

We compared patient demographics, comorbidities, hospital LOS, and early postoperative complications in both alloplastic (tissue expander and direct-to-implant) and autologous breast reconstruction patients. We examined complication outcomes of interest which included superficial and deep surgical site infections (SSIs), wound dehiscence, unplanned

return to the operating room, unplanned readmission, and medical complications (e.g. pneumonia, pulmonary embolism, cerebrovascular accident with deficits, cardiac arrest, myocardial infection, sepsis, septic shock).

Variables of interest included age, race, ethnicity, body mass index (BMI), diabetes, smoking history, dyspnea, functional status, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension requiring medications, renal failure, dialysis requirement, steroid use, bleeding disorders, American Society of Anesthesiologists (ASA) classification, operative times, inpatient/outpatient status, and total LOS in days. Categorical variables were evaluated using Fisher's exact test while continuous variables were compared using Student's T-test. Inpatient and outpatient procedures were classified based on the "Inpatient/Outpatient" variable within the NSQIP dataset. A p-value of <0.05 was considered significant. Statistical analyses were performed using R statistical software (version 4.0.3, packages: tidyverse).

Within the 2020 alloplastic cohorts, we compared patients with a hospital LOS of 0 versus 1 day on the basis of demographics and complications. Within the 2020 autologous cohorts, we compared patients with a LOS of 0–2 versus 3 days, similarly comparing demographics and complications. We chose to compare autologous reconstruction patients with LOS 0–2 versus LOS of 3 days as we believe it is clinically reasonable to move towards LOS of 2 days for autologous reconstruction patients, which is now the standard of care at our institution.

RESULTS

Analysis of Alloplastic Patients

A total of 15,364 patients who underwent mastectomy with immediate breast reconstruction in 2019 and 2020 were examined (2019: 8,029 patients; 2020: 7,335 patients). When comparing 2019 versus 2020 alloplastic breast reconstruction patients, there was no significant difference in age distribution (Table 1), with the majority of patients between 40–49 years of age. Race distribution differed minimally, with a slightly higher proportion of black patients undergoing alloplastic reconstruction in 2020 than in 2019 (2019: 8.4%; 2020: 10.6%, $p < 0.0001$). The majority of patients in both cohorts had a normal BMI (18.5–24.9 kg/m²), and there were no significant differences in BMI distribution between the 2019 and 2020 cohorts. A higher percentage of 2020 patients had hypertension requiring medication in comparison to the 2019 patients (2019: 20.8%; 2020: 22.9%, $p = 0.006$). The majority of patients in both cohorts had a functional status of independent, and there were significantly more patients who were partially dependent in 2020 compared to 2019 ($p = 0.034$). Comorbidity rates were low for the entirety of the cohort, and there were no significant differences in diabetes, smoking history, baseline dyspnea, COPD, ascites, CHF, renal failure, dialysis requirements, steroid use, or bleeding disorders between the 2019 and 2020 cohorts. While the majority of alloplastic reconstruction patients overall were ASA class 2, there was a higher proportion of ASA class 3 patients in 2020 than in 2019 ($p < 0.0001$). Mean operative time was longer in 2020 (2019: 207.3 minutes; 2020: 212.9 minutes, $p = 0.0001$). A significantly higher proportion of alloplastic cases were outpatient in 2020 in comparison to 2019 (2019: 65.6%; 2020: 73.8%, $p < 0.0001$). The proportion of

patients with LOS of 0 days increased from 9.6% to 25.9%, while the proportion of patients with LOS of 1 day decreased from 70.7% to 61.2% ($p < 0.0001$). The proportion of patients with LOS of 2 days decreased from 14.5% to 9.2% ($p < 0.0001$) (Table 1, Figure 1).

When comparing complication rates in 2019 versus 2020, there were no significant differences in any surgical or medical postoperative complications (Table 2). In both 2019 and 2020, the most commonly occurring complications were unplanned return to the operating room (2019: 7.6%; 2020: 7.5%), unplanned readmission (2019: 4.1%; 2020: 3.5%), unplanned readmission related to the primary procedure (2019: 3.8%; 2020: 3.3%), and superficial (2019: 2.7%; 2020: 2.3%) and deep (2019: 2.9%; 2020: 3.2%) SSIs.

Analysis of Autologous Patient Cohort

When comparing patients who underwent autologous breast reconstruction in 2019 versus 2020, we noted no significant differences in age, race, ethnicity, BMI, functional status, comorbidities, or ASA Class (Table 3). In comparison to 2019, the median operative time was shorter in 2020 (2019: 476.0 minutes; 2020: 446.5 minutes, $p = 0.001$). Overall, the highest proportion of autologous patients had a LOS of 3 days compared to other days (2019: 35.4%; 2020: 40.6%, $p < 0.0001$). From 2019 to 2020, there was an increase in the proportion of patients with LOS 3 days and a decrease in the proportion of patients staying for 4 days ($p < 0.0001$) (Table 3, Figure 2).

When examining 2019 versus 2020 autologous reconstruction complication rates, the only complication which increased significantly from 2019 to 2020 was deep SSI (2.0% vs 3.6%, $p = 0.024$) (Table 4). There were no other differences in rates of postoperative complications between the 2019 and 2020 autologous reconstruction cohorts.

2020 Alloplastic and Autologous Cohort LOS Analysis

In 2020, age distribution did not differ for alloplastic patients with LOS 0 days versus LOS 1 day ($p = 0.249$); however, differences were noted in race and ethnicity distribution ($p < 0.001$) (Table 5). Patients with LOS 1 day were more likely to have obesity, COPD, HTN requiring medication, higher ASA class, and longer mean operative times (187.5 minutes vs 221.9 minutes, $p < 0.001$). Patients with LOS 1 day also had higher rates of unplanned reoperation (5.1% vs 8.3%, $p < 0.001$), unplanned readmission (2.1% vs 4.0%, $p < 0.001$), sepsis (0.6% vs 0.1%, $p = 0.003$) and unplanned readmission related to primary procedure (1.9% vs 3.8%, $p < 0.001$) (Table 6).

In 2020, in comparison to autologous patients with LOS 0–2 days, patients staying for 3 days were younger (< 50 years) ($p < 0.0001$), had lower rates of hypertension requiring medication (29.8% vs 20.8%, $p = 0.013$), and had longer mean operative times (340.2 minutes vs 482.6 minutes, $p < 0.0001$) (Table 7). Patients with LOS 3 days also had higher rates of superficial SSI (3.9% vs 8.3%, $p = 0.04$), unplanned reoperation (2.2% vs 7.5%, $p = 0.007$), unplanned readmission (2.2% vs 7.5%, $p = 0.007$), and unplanned readmission related to primary procedure (1.7% vs 7.0%, $p = 0.005$) (Table 8).

DISCUSSION

The COVID-19 pandemic placed hospital systems nationwide under strain as inpatient beds were filled to capacity.^[14] During this time, there were unique pressures placed on reconstructive surgeons to shift practices and move toward outpatient breast reconstruction surgery or shortened hospital LOS when clinically appropriate. The pandemic forced providers to rethink current standards of care, while simultaneously providing a means to assess the impact of shorter LOS following breast reconstruction on postoperative complications.

Our analysis of the NSQIP dataset from 2019–2020 provides insight on how COVID-19 impacted breast reconstruction and changed practice management. While overall breast reconstruction rates were unchanged from 2019 to 2020, there was a notable shift towards outpatient alloplastic reconstruction, with significantly more patients having breast reconstruction performed on an outpatient basis compared to pre-pandemic rates.^[1] Similar trends were seen across other surgical subspecialties during the pandemic.^[15, 16] Similarly, inpatient LOS for both autologous and alloplastic breast reconstruction shifted towards decreased hospital LOS in an effort to minimize patient exposure to COVID-19 while ensuring more inpatient bed availability.

In patients who underwent alloplastic reconstruction, no significant differences were seen in early postoperative complications between the 2019 and 2020 cohorts. Similarly, in the autologous cohort, the only significant difference seen was an increase in deep SSI in 2020. Taken as a whole, these results suggest that, largely, earlier discharge of autologous and alloplastic breast reconstruction patients and/or outpatient alloplastic breast reconstruction did not significantly impact 30-day surgical and medical complications. These results align with several single center studies. Faulker et al. assessed alloplastic reconstruction during the first three months of the COVID-19 restrictions and found no significant differences in complication rates when compared to the 2019 pre-pandemic alloplastic cohort, emphasizing the utility of same day discharge for these patients.^[17] Other surgical centers have demonstrated the safety of same day discharge after implant-based reconstruction, with similar results on postoperative complications.^[6, 18–20] Marxen et al. conducted a systematic review of same day discharge for immediate alloplastic breast reconstruction and found that, relative to patients who stayed overnight, there were comparable rates of common complications with no increase in readmission or reoperation rates.^[21] Early discharge after autologous reconstruction has also been published with promising results for potential same day discharge in properly-selected patients with a modified recovery protocol.^[22, 23]

To further understand the effect of earlier discharge, subset analysis was performed within both the alloplastic and autologous reconstruction cohorts. In the alloplastic cohort, same-day discharge patients overall had lower BMIs and ASA classes, as well as lower rates of COPD and hypertension requiring medication. When complications were compared between the same-day discharge cohort and patients discharged on postoperative day 1, the patients discharged on postoperative day 1 had significantly higher rates of return to OR for unplanned operations and unplanned readmission. In essence, the event of a complication requiring take back to the OR acted as a barrier to early discharge and was conceivably

the reason for the longer LOS in this patient cohort. Our subset analysis provides further evidence that same-day discharge after alloplastic reconstruction is safe in properly-selected patients, with similar rates of complications.

A subset analysis was also conducted within the autologous cohort to better understand the effect of shorter LOS within this patient population. Patients that were discharged on postoperative day 0 through 2 were compared to patients that were discharged on postoperative day 3. Patients in the earlier discharge group tended to be older and had shorter operative times. Operative times in the earlier discharge group were significantly different, with 340 minutes average in the early discharge cohort compared to 482 minutes in the cohort with discharge on postoperative day 3. This 142-minute difference may be due to unanticipated surgical complexity or intraoperative complications related to free flap harvest or microsurgical anastomosis, although the direct causation for the difference in OR time cannot be determined by the NSQIP database and is only speculation. Another possible explanation for significant difference in hospital LOS is the laterality of free flap reconstruction, as many institutions aim for earlier discharge in patients undergoing unilateral rather than bilateral reconstruction.^[24, 25] Unfortunately, while NSQIP identifies unilateral and bilateral breast reconstruction cases, it does not provide laterality of complications, which is a limitation of using this database.

Patients that underwent autologous reconstruction that were discharged on postoperative day 3 had higher rates of superficial SSIs, return to the OR for unplanned reoperation, and unplanned readmissions. One explanation for the relationship between autologous reconstruction patients with longer LOS (3 days) having increased operative times in addition to increased rates of unplanned return to the OR may be partially explained by technical issues with the anastomoses intraoperatively, which would not only prolong OR time but also increase chances of return to the OR. As we observed with the alloplastic group, higher rate of unplanned return to the OR likely prolonged the need for inpatient monitoring and therefore led to longer LOS. Besides these notable differences, there were no other significant differences in complication rates between the patients discharged earlier and those requiring longer hospital LOS in the autologous cohort. These results suggest that early discharge may be safe, with a slightly increased risk of superficial SSI. A potential reason for this, given our clinical context, involves limited time for education about perioperative care or regimens. A typical concern of early discharge after autologous breast reconstruction is need for free flap monitoring. However, a recent study by Carruthers et al. found that in their series of 301 deep inferior epigastric perforator (DIEP) flaps, all microvascular issues occurred within the first 23 hours postoperatively, which calls into question the need for lengthy flap monitoring protocols and the potential for shorter inpatient stays.^[26] This is precisely the rationale for our institution's new postoperative protocol for patients undergoing unilateral DIEP flaps.^[27] In a recent quality improvement initiative, we demonstrate that a 48-hour discharge following unilateral DIEP flap reconstruction is feasible when traditional aspects of inpatient nursing are integrated into outpatient care without an increase in complications. This is in line with the outcomes of the current study, which also demonstrates that a trend towards shorter LOS during the pandemic did not significantly affect postoperative complications.

Reducing inpatient LOS after breast reconstruction has important implications for the United States healthcare system and should be pursued given data demonstrating the safety of shorter hospitalizations for some patients. In an era of increasing cost and expenditures across the United States healthcare system, it is critical to prioritize cost-efficiency while maintaining clinical excellence. Recent implementation of innovative payment reforms such as bundled payments have risen to prominence.^[28, 29] Bundling of payment for several plastic surgery procedures is especially interesting as it places the onus on providers to have optimal outcomes. During COVID-19, providers had an incentive to decrease LOS while ensuring that complication rates remained within acceptable limits. Providers must bear in mind that superior medical care includes successful cost-cutting measures and safe reduction of hospitalization times, which is important especially at a time when medical expenditures reach all-time highs.^[29] Overall, the complex work involved in optimizing payment for breast reconstruction underscores the need to preserve limited resources and increase sustainability of highly consumptive plastic surgery procedures, such as microsurgery procedures. Our data demonstrates that shortened LOS, in conjunction with exceptional patient care, can be one way to reduce costs following breast reconstruction.

In addition to helping mitigate costs, decreasing LOS itself can be associated with better patient outcomes. Numerous centers have begun implementing enhanced recovery after surgery (ERAS) protocols toward this end.^[30–34] Research shows that early discharge carries the benefits of decreased exposure to hospital-acquired infections and improved patient satisfaction.^[35] Outcomes are often further improved through earlier ambulation, helping prevent venous thromboembolism, a leading cause of perioperative morbidity and mortality.^[36] In this way, shorter LOS can work in concert with efforts to enhance clinical outcomes.

We acknowledge several limitations with this study. First, the data in our study is from a large national database derived mainly from CPT codes, which can be subject to miscoding. Our study is retrospective in nature which can introduce external biases which we cannot control. Moreover, the NSQIP database includes up to 30-day complications and, therefore, we are not able to include long-term complications. This study did not analyze delayed reconstruction, which was also likely impacted by the pandemic as surgeons intentionally postponed reconstruction. While our sample size was large enough to provide adequate statistical power to detect the effect of the exposure on the outcome, and our study population was homogeneous with minimal variability in relevant confounding variables, there is still a possibility that confounding variables can influence results of the study. Lastly, by virtue of their high power, large database studies can oftentimes find statistically significant differences or relationships between cohorts; thus, the difference between statistical significance and clinical significance must be considered. While some relationships can be statistically significant, critical examination is needed to make clinically appropriate and applicable conclusions when interpreting the data from these large studies.

Using the NSQIP database, this study allows for a high-level view of the effect of early discharge on a wide range of patients and plastic surgery providers. Overall, our data suggests that early discharge can be safe without an increase in early 30-day complications in properly selected patients. However, our study is unable to provide details as to the

specific provider selection criteria for patients who can tolerate earlier discharge, which should be a topic for future research.

CONCLUSIONS

During 2020, hospital LOS decreased for all breast reconstruction patients with no complication differences in alloplastic patients and an increase in deep SSIs only in autologous patients. Our findings of shorter length of stay with relatively low complication risk are a noteworthy step for further research as, in appropriately selected patients, shorter LOS may improve patient satisfaction and lower healthcare costs.

Acknowledgments

This research was funded in part through the NIH/NCI Cancer Center Support Grant P30 CA008748, which supports Memorial Sloan Kettering Cancer Center's research infrastructure.

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Synopsis:

This research examines the effect of the COVID-19 pandemic on the complication profiles of both implant-based and autologous reconstruction.

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Total Length of Hospital Stay for Alloplastic Patients

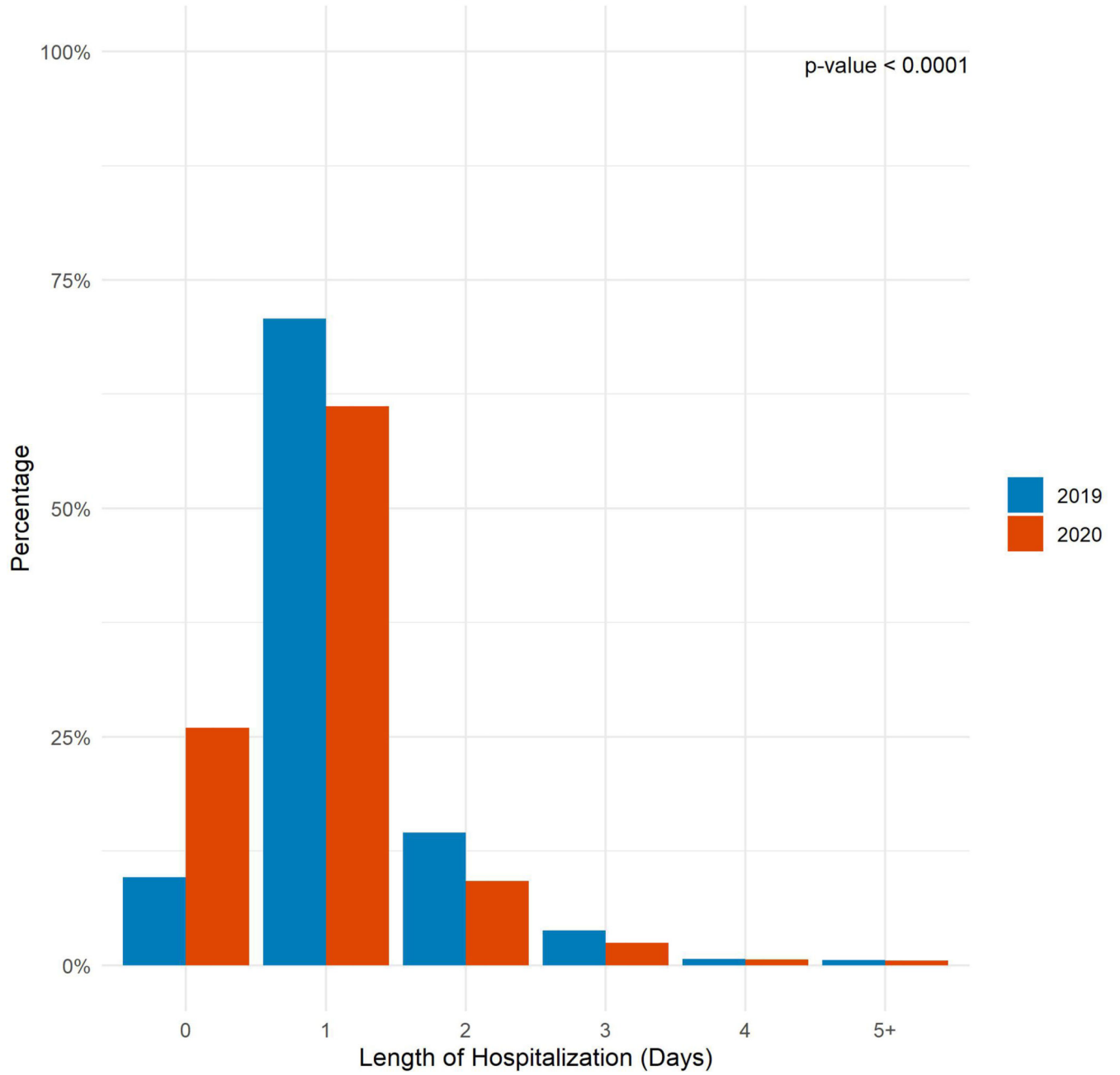


Figure 1. Percentage of patients receiving alloplastic reconstruction discharged on each postoperative day, depending on year of surgery, 2019 or 2020.

Total Length of Hospital Stay for Autologous Patients

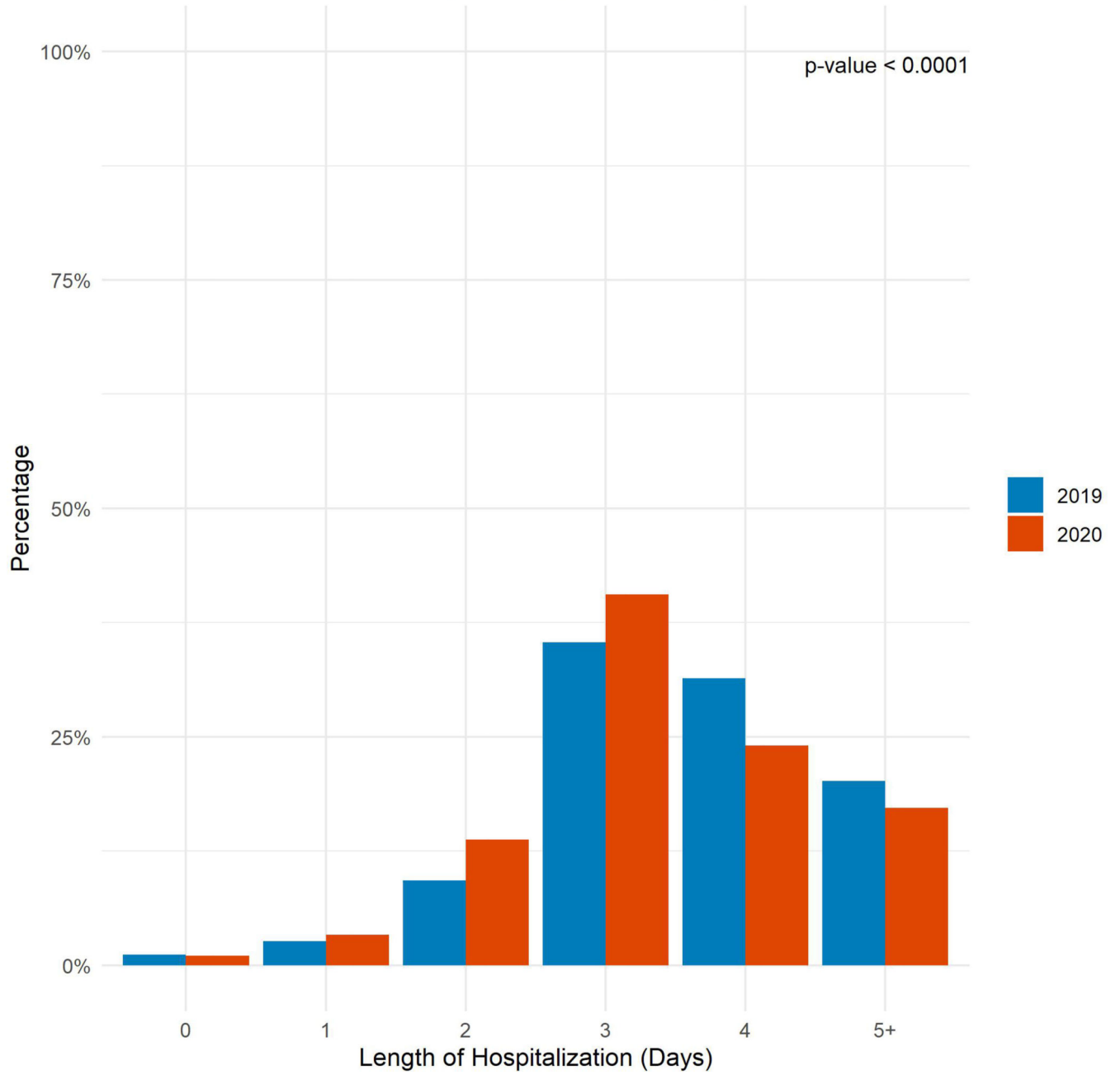


Figure 2. Percentage of patients receiving autologous reconstruction discharged on each postoperative day, depending on year of surgery, 2019 or 2020.

Table 1.

Demographic and Clinical Variables of Alloplastic Reconstruction Cohort (2019 vs 2020)

| | 2019 | 2020 | p-value |
|---|---------------|---------------|---------|
| No. of Alloplastic Reconstruction Patients | 6,806 | 6,354 | |
| Age Distribution, years | | | 0.640 |
| <40 | 18.2% (1,236) | 18.9% (1,204) | |
| 40–49 | 31.8% (2,167) | 31.1% (1,976) | |
| 50–59 | 26.8% (1,823) | 27.1% (1,721) | |
| 60–69 | 17.2% (1,169) | 17.2% (1,096) | |
| 70–79 | 5.8% (395) | 5.3% (339) | |
| 80+ | 0.2% (16) | 0.3% (18) | |
| Race | | | <0.0001 |
| White | 71.0% (4,832) | 70.4% (4,471) | |
| Black or African American | 8.4% (569) | 10.6% (671) | |
| Asian | 4.5% (304) | 4.5% (287) | |
| American Indian or Alaska Native | 0.3% (17) | 0.4% (24) | |
| Native Hawaiian or Pacific Islander | 0.4% (27) | 0.2% (15) | |
| Unknown/Not Reported | 15.5% (1,057) | 13.9% (886) | |
| Ethnicity | | | 0.001 |
| Hispanic | 8.2% (556) | 9.4% (600) | |
| Not Hispanic | 80.6% (5,484) | 81.0% (5,146) | |
| Unknown | 11.3% (766) | 9.6% (608) | |
| BMI | | | 0.425 |
| <18.5 (Underweight) | 1.4% (95) | 1.4% (90) | |
| 18.5–24.9 (Normal) | 37.1% (2,518) | 36.4% (2,306) | |
| 25.0–29.9 (Overweight) | 31.2% (2,115) | 30.6% (1,935) | |
| ≥30 (Obese) | 30.3% (2,052) | 31.6% (2,001) | |
| Diabetes | | | 0.439 |
| No | 94.2% (6,408) | 93.9% (5,967) | |
| Oral Agents (Non-Insulin) | 4.6% (310) | 4.5% (288) | |
| Insulin | 1.3% (88) | 1.6% (99) | |
| Smoking History | | | 0.053 |
| Yes | 8.4% (569) | 7.4% (473) | |
| No | 91.6% (6,237) | 92.6% (5,881) | |
| Dyspnea | | | 0.547 |
| No | 98.2% (6,682) | 98.2% (6,242) | |
| Moderate Exertion | 1.8% (120) | 1.7% (111) | |
| At Rest | 0.1% (4) | 0.02% (1) | |
| Functional Status | | | 0.034 |
| Independent | 99.8% (6,792) | 99.5% (6,325) | |

| | 2019 | 2020 | p-value |
|---|----------------|----------------|---------|
| Partially Dependent | 0.1% (4) | 0.2% (11) | |
| Totally Dependent | 0.0% (0) | 0.0% (0) | |
| Unknown | 0.1% (10) | 0.3% (18) | |
| Chronic Obstruction Pulmonary Disease | | | 0.725 |
| Yes | 0.5% (36) | 0.6% (37) | |
| No | 99.5% (6770) | 99.4% (6317) | |
| Ascites | | | 1 |
| Yes | 0.0% (1) | 0.0% (0) | |
| No | 100.0% (6805) | 100.0% (6354) | |
| Congestive Heart Failure | | | 0.166 |
| Yes | 0.0% (2) | 0.1% (6) | |
| No | 100.0% (6804) | 99.9% (6348) | |
| Hypertension Requiring Medication | | | 0.006 |
| Yes | 20.8% (1419) | 22.9% (1452) | |
| No | 79.2% (5387) | 77.1% (4902) | |
| Renal Failure | | | 1 |
| Yes | 0.0% (1) | 0.0% (0) | |
| No | 100.0% (6805) | 100.0% (6354) | |
| Dialysis | | | 1 |
| Yes | 0.0% (3) | 0.0% (2) | |
| No | 100.0% (6803) | 100.0% (6352) | |
| Steroid Use | | | 0.320 |
| Yes | 2.1% (146) | 2.4% (153) | |
| No | 97.9% (6660) | 97.6% (6201) | |
| Bleeding Disorders | | | 0.564 |
| Yes | 0.8% (53) | 0.9% (56) | |
| No | 99.2% (6753) | 99.1% (6298) | |
| ASA Class | | | <0.0001 |
| 1 – Normal health | 6.4% (435) | 5.9% (373) | |
| 2 – Mild systemic disease without functional limitations | 67.5% (4,594) | 64.4% (4,091) | |
| 3 – Severe systemic disease with some functional limitations | 25.8% (1,758) | 29.4% (1,867) | |
| 4 – Severe systemic disease that is a constant threat to life | 0.3% (19) | 0.3% (20) | |
| 5 – Not expected to survive without the operation | 0.0% (0) | 0.0% (1) | |
| Operative Time, minutes | | | 0.0001 |
| Mean, SD | 207.3 (82.118) | 212.9 (83.253) | |
| Median, IQR | 196 (150, 253) | 202 (154, 258) | |
| Inpatient/Outpatient | | | <0.0001 |
| Inpatient | 34.4% (2,338) | 26.2% (1,665) | |
| Outpatient | 65.6% (4,468) | 73.8% (4,689) | |

| | 2019 | 2020 | p-value |
|--------------------------------------|---------------|---------------|---------|
| Length of Hospital Stay, days | | | <0.0001 |
| 0 Days | 9.6% (654) | 25.9% (1,651) | |
| 1 Day | 70.7% (4,814) | 61.2% (3,888) | |
| 2 Days | 14.5% (986) | 9.2% (585) | |
| 3 Days | 3.8% (261) | 2.5% (157) | |
| 4 Days | 0.7% (47) | 0.6% (39) | |
| 5 Days | 0.6% (39) | 0.5% (34) | |

* Any data which was missing or reported as “NULL” was excluded from the reported distributions

BMI, body mass index; ASA, American Society of Anesthesiologists; SD, standard deviation; IQR, interquartile range

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Table 2:

Complications for Alloplastic Reconstruction Cohort (2019 vs 2020)

| Complications | 2019 | 2020 | p-value |
|--|------------|------------|---------|
| Superficial Surgical Site Infection | 2.7% (183) | 2.3% (147) | 0.181 |
| Deep Surgical Site Infection | 2.9% (194) | 3.2% (204) | 0.241 |
| Wound Dehiscence/Disruption | 1.0% (68) | 0.8% (50) | 0.229 |
| Unplanned Intubation | 0.1% (4) | 0.02% (1) | 0.376 |
| Ventilator Occurrences > 48 hours | 0.0% (3) | 0.0% (0) | 0.251 |
| Pneumonia | 0.0% (3) | 0.1% (5) | 0.495 |
| Pulmonary Embolism | 0.2% (11) | 0.2% (10) | 1.000 |
| Cerebrovascular Accident with deficits (stroke) | 0.02% (1) | 0.0% (1) | 1.000 |
| Cardiac Arrest with cardiopulmonary resuscitation | 0.0% (1) | 0.0% (0) | 1.000 |
| Myocardial Infarction (Intra- or Post-operative) | 0.0% (3) | 0.0% (0) | 0.251 |
| Sepsis | 0.6% (41) | 0.5% (29) | 0.281 |
| Septic Shock | 0.1% (4) | 0.0% (0) | 0.126 |
| Return to OR for Unplanned Reoperation | 7.6% (519) | 7.5% (474) | 0.741 |
| Unplanned Readmission | 4.1% (281) | 3.5% (225) | 0.085 |
| Unplanned Readmission Related to Primary Procedure | 3.8% (258) | 3.3% (210) | 0.144 |

OR, operating room

Table 3:

Demographic and Clinical Variables of Autologous Reconstruction Cohort (2019 vs 2020)

| | 2019 | 2020 | p-value |
|--|--------------|-------------|---------|
| No. of Autologous Reconstruction Patients | 1,223 | 981 | |
| Age Distribution, years | | | 0.784 |
| <40 | 11.4% (140) | 11.3% (111) | |
| 40–49 | 31.2% (382) | 32.4% (318) | |
| 50–59 | 33.5% (410) | 34.4% (337) | |
| 60–69 | 20.9% (256) | 18.6% (182) | |
| 70–79 | 2.7% (33) | 3.2% (31) | |
| 80+ | 0.2% (2) | 0.2% (2) | |
| Race | | | 0.702 |
| White | 56.4% (690) | 53.8% (528) | |
| Black or African American | 11.4% (140) | 13.6% (133) | |
| Asian | 6.1% (75) | 6.0% (59) | |
| American Indian or Alaska Native | 0.1% (1) | 0.1% (1) | |
| Native Hawaiian or Pacific Islander | 0.1% (1) | 0.1% (1) | |
| Unknown/Not Reported | 25.8% (316) | 26.4% (259) | |
| Ethnicity | | | 0.528 |
| Hispanic | 8.8% (108) | 7.5% (74) | |
| Not Hispanic | 70.2% (858) | 71.7% (703) | |
| Unknown | 21.0% (257) | 20.8% (204) | |
| BMI | | | |
| <18.5 (Underweight) | 0.2% (3) | 0.1% (1) | 0.097 |
| 18.5–24.9 (Normal) | 19.2% (234) | 22.8% (222) | |
| 25.0–29.9 (Overweight) | 33.6% (409) | 34.3% (334) | |
| ≥30 (Obese) | 46.9% (571) | 42.8% (416) | |
| Diabetes | | | 0.088 |
| No | 93.2% (1140) | 92.9% (911) | |
| Oral Agents (Non-Insulin) | 6.0% (73) | 5.3% (52) | |
| Insulin | 0.8% (10) | 1.8% (18) | |
| Smoking History | | | 0.713 |
| Yes | 6.0% (73) | 5.5% (54) | |
| No | 94.0% (1150) | 94.5% (927) | |
| Dyspnea | | | 0.385 |
| No | 98.7% (1207) | 98.2% (963) | |
| Moderate Exertion | 1.3% (16) | 1.8% (18) | |
| At Rest | 0.0% (0) | 0.0% (0) | |
| Functional Status | | | 0.556 |
| Independent | 99.8% (1221) | 99.6% (977) | |

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| | 2019 | 2020 | p-value |
|---|----------------|--------------------|---------|
| Partially Dependent | 0.1% (1) | 0.3% (3) | |
| Totally Dependent | 0.0% (0) | 0.0% (0) | |
| Unknown | 0.1% (1) | 0.1% (1) | |
| Chronic Obstruction Pulmonary Disease | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (1,223) | 100.0% (981) | |
| Ascites | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (1,223) | 100.0% (981) | |
| Congestive Heart Failure | | | 0.634 |
| Yes | 0.2% (3) | 0.1% (1) | |
| No | 99.8% (1220) | 99.9% (980) | |
| Hypertension Requiring Medication | | | 0.132 |
| Yes | 25.3% (309) | 22.4% (220) | |
| No | 74.7% (914) | 77.6% (761) | |
| Renal Failure | | | |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (1,223) | 100.0% (981) | |
| Dialysis | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (1,223) | 100.0% (981) | |
| Steroid Use | | | 0.869 |
| Yes | 1.6% (20) | 1.7% (17) | |
| No | 98.4% (1203) | 98.3% (964) | |
| Bleeding Disorders | | | 0.527 |
| Yes | 0.6% (7) | 0.3% (3) | |
| No | 99.4% (1216) | 99.7% (978) | |
| ASA Class | | | 0.076 |
| 1 – Normal health | 3.4% (41) | 4.5% (44) | |
| 2 – Mild systemic disease without functional limitations | 65.7% (803) | 60.6% (594) | |
| 3 – Severe systemic disease with some functional limitations | 30.6% (374) | 34.5% (338) | |
| 4 – Severe systemic disease that is a constant threat to life | 0.4% (5) | 0.5% (5) | |
| 5 – Not expected to survive without the operation | 0.0% (0) | 0% (0) | |
| Operative Time, minutes | | | 0.001 |
| Mean, SD | 481.9 (179.2) | 456.8 (165.9) | |
| Median, IQR | 476 (363, 581) | 446.5 (350, 545.3) | |
| Inpatient/Outpatient | | | 0.918 |
| Inpatient | 95.3% (1,166) | 95.5% (937) | |
| Outpatient | 4.7% (57) | 4.5% (44) | |

| | 2019 | 2020 | p-value |
|--------------------------------------|-------------|-------------|---------|
| Length of Hospital Stay, days | | | <0.0001 |
| 0 Days | 1.1% (14) | 1.0% (10) | |
| 1 Day | 2.6% (32) | 3.4% (33) | |
| 2 Days | 9.3% (113) | 13.8% (135) | |
| 3 Days | 35.4% (431) | 40.6% (398) | |
| 4 Days | 31.4% (383) | 24.1% (236) | |
| 5 Days | 20.2% (246) | 17.2% (169) | |

* Any data which was missing or reported as “NULL” was excluded from the reported distributions

ASA, American Society of Anesthesiologists; SD, standard deviation; IQR, interquartile range

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Table 4:

Complications for Autologous Reconstruction Cohort (2019 vs 2020)

| Complications | 2019 | 2020 | p-value |
|--|-------------|-------------|---------|
| Superficial Surgical Site Infection | 6.6% (81) | 7.5% (74) | 0.403 |
| Deep Surgical Site Infection | 2.0% (24) | 3.6% (35) | 0.024 |
| Wound Dehiscence/Disruption | 2.2% (27) | 1.8% (18) | 0.650 |
| Unplanned Intubation | 0.0% (0) | 0.2% (2) | 0.198 |
| Ventilator Occurrences > 48 hours | 0.1% (1) | 0.2% (2) | 0.589 |
| Pneumonia | 0.2% (2) | 0.4% (4) | 0.416 |
| Pulmonary Embolism | 0.7% (9) | 0.2% (2) | 0.126 |
| Cerebrovascular Accident with deficits (stroke) | 0.0% (0) | 0.1% (1) | 0.445 |
| Cardiac Arrest with cardiopulmonary resuscitation | 0.0% (0) | 0.0% (0) | 1.000 |
| Myocardial Infarction (Intra- or Post-operative) | 0.0% (0) | 0.1% (1) | 0.445 |
| Sepsis | 0.6% (7) | 0.6% (6) | 1.000 |
| Septic Shock | 0.2% (2) | 0% (0) | 0.506 |
| Return to OR for Unplanned Reoperation | 12.8% (157) | 12.7% (125) | 1.000 |
| Unplanned Readmission | 6.4% (78) | 6.5% (64) | 0.931 |
| Unplanned Readmission Related to Primary Procedure | 6.2% (76) | 6.0% (59) | 0.859 |

OR, operating room

Table 5.

Demographics 2020 Alloplastic Patients 0 days LOS vs 1+ days LOS

| | 0 days LOS | 1+ days LOS | p-value |
|---|-------------------|--------------------|----------------|
| No. of Alloplastic Reconstruction Patients | 1651 | 4703 | |
| Age Distribution, years | | | 0.249 |
| <40 | 17.9% (296) | 19.3% (908) | |
| 40–49 | 32.0% (528) | 30.8% (1448) | |
| 50–59 | 27.8% (459) | 26.8% (1262) | |
| 60–69 | 17.7% (292) | 17.1% (804) | |
| 70–79 | 4.4% (73) | 5.7% (266) | |
| 80+ | 0.2% (3) | 0.3% (15) | |
| Race | | | <0.001 |
| White | 66.3% (1095) | 71.8% (3376) | |
| Black or African American | 8.1% (134) | 11.4% (537) | |
| Asian | 6.1% (101) | 4.0% (186) | |
| American Indian or Alaska Native | 0.2% (4) | 0.4% (20) | |
| Native Hawaiian or Pacific Islander | 0.1% (1) | 0.3% (14) | |
| Unknown/Not Reported | 19.1% (316) | 12.1% (570) | |
| Ethnicity | | | <0.001 |
| Hispanic | 11.1% (183) | 8.9% (417) | |
| Not Hispanic | 74.0% (1222) | 83.4% (3924) | |
| Unknown | 14.9% (246) | 7.7% (362) | |
| BMI | | | <0.001 |
| <18.5 (Underweight) | 1.7% (28) | 1.3% (62) | |
| 18.5–24.9 (Normal) | 41.1% (675) | 34.8% (1631) | |
| 25.0–29.9 (Overweight) | 30.5% (501) | 30.6% (1434) | |
| ≥30 (Obese) | 26.7% (439) | 33.3% (1562) | |
| Diabetes | | | 0.060 |
| No | 95.1% (1570) | 93.5% (4397) | |
| Oral Agents (Non-Insulin) | 3.6% (59) | 4.9% (229) | |
| Insulin | 1.3% (22) | 1.6% (77) | |
| Smoking History | | | 0.091 |
| Yes | 6.5% (107) | 7.8% (366) | |
| No | 93.5% (1544) | 92.2% (4337) | |
| Dyspnea | | | 0.068 |
| No | 98.6% (1628) | 98.1% (4614) | |
| Moderate Exertion | 1.3% (22) | 1.9% (89) | |
| At Rest | 0.1% (1) | 0.0% (0) | |
| Functional Status | | | 0.710 |
| Independent | 99.7% (1646) | 99.5% (4679) | |

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| | 0 days LOS | 1+ days LOS | p-value |
|---|----------------|----------------|---------|
| Partially Dependent | 0.1% (2) | 0.2% (9) | |
| Totally Dependent | 0.0% (0) | 0.0% (0) | |
| Unknown | 0.2% (3) | 0.3% (15) | |
| Chronic Obstruction Pulmonary Disease | | | 0.037 |
| Yes | 0.2% (4) | 0.7% (33) | |
| No | 99.8% (1647) | 99.3% (4670) | |
| Ascites | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (1651) | 100.0% (4703) | |
| Congestive Heart Failure | | | 0.349 |
| Yes | 0.0% (0) | 0.1% (6) | |
| No | 100% (1651) | 99.9% (4697) | |
| Hypertension Requiring Medication | | | 0.005 |
| Yes | 20.4% (336) | 23.7% (1116) | |
| No | 79.6% (1315) | 76.3% (3587) | |
| Renal Failure | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (1651) | 100.0% (4703) | |
| Dialysis | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (2) | |
| No | 100.0% (1651) | 99.9% (4701) | |
| Steroid Use | | | 0.162 |
| Yes | 1.9% (32) | 2.6% (121) | |
| No | 98.1% (1619) | 97.4% (4582) | |
| Bleeding Disorders | | | 0.541 |
| Yes | 0.7% (12) | 0.9% (44) | |
| No | 99.3% (1639) | 99.1% (4659) | |
| ASA Class | | | 0.001 |
| 1 – Normal health | 6.4% (105) | 5.7% (268) | |
| 2 – Mild systemic disease without functional limitations | 67.8% (1120) | 63.2% (2971) | |
| 3 – Severe systemic disease with some functional limitations | 25.5% (421) | 30.8% (1446) | |
| 4 – Severe systemic disease that is a constant threat to life | 0.3% (5) | 0.3% (15) | |
| 5 – Not expected to survive without the operation | 0.0% (0) | 0.0% (1) | |
| Operative Time, minutes | | | <0.001 |
| Mean, SD | 187.5 (70.874) | 221.8 (85.421) | |
| Median, IQR | 178 (137,223) | 210 (161,269) | |

* Any data which was missing or reported as “NULL” was excluded from the reported distributions

BMI, body mass index; ASA, American Society of Anesthesiologists; SD, standard deviation; IQR, interquartile range

Table 6:

Complications 2020 Alloplastic 0 days LOS vs 1+ days LOS

| Complications | 0 days LOS | 1+ days LOS | p-value |
|--|------------|-------------|---------|
| Superficial Surgical Site Infection | 2.2% (36) | 2.4% (111) | 0.775 |
| Deep Surgical Site Infection | 2.7% (44) | 3.4% (160) | 0.167 |
| Wound Dehiscence/Disruption | 0.7% (12) | 0.8% (38) | 0.872 |
| Unplanned Intubation | 0.0% (0) | 0.0% (1) | 1 |
| Ventilator Occurrences > 48 hours | 0.0% (0) | 0.0% (0) | 1 |
| Pneumonia | 0.1% (1) | 0.1% (4) | 1 |
| Pulmonary Embolism | 0.2% (3) | 0.1% (7) | 0.726 |
| Cerebrovascular Accident with deficits (stroke) | 0.0% (0) | 0.0% (1) | 1 |
| Cardiac Arrest with cardiopulmonary resuscitation | 0.0% (0) | 0.0% (0) | 1 |
| Myocardial Infarction (Intra- or Post-operative) | 0.0% (0) | 0.0% (0) | 1 |
| Sepsis | 0.1% (1) | 0.6% (28) | 0.003 |
| Septic Shock | 0.0% (0) | 0.0% (0) | 1 |
| Return to OR for Unplanned Reoperation | 5.1% (84) | 8.3% (390) | <0.001 |
| Unplanned Readmission | 2.1% (35) | 4.0% (190) | <0.001 |
| Unplanned Readmission Related to Primary Procedure | 1.9% (32) | 3.8% (178) | <0.001 |

OR, operating room

Table 7.

Demographics 2020 Autologous 0–2 days LOS vs 3+ days LOS

| | 0–2 days LOS | 3+ days LOS | p-value |
|--|--------------|-------------|---------|
| No. of Autologous Reconstruction Patients | 178 | 803 | |
| Age Distribution, years | | | |
| <40 | 6.7% (12) | 12.3% (99) | 0.013 |
| 40–49 | 30.3% (54) | 32.9% (264) | |
| 50–59 | 35.9% (64) | 33.9% (273) | |
| 60–69 | 20.8% (37) | 18.1% (145) | |
| 70–79 | 5.1% (9) | 2.7% (22) | |
| 80+ | 1.1% (2) | 0.0% (0) | |
| Race | | | <0.0001 |
| White | 58.9% (105) | 52.7% (423) | |
| Black or African American | 19.7% (35) | 12.2% (98) | |
| Asian | 7.9% (14) | 5.6% (45) | |
| American Indian or Alaska Native | 0.6% (1) | 0.0% (0) | |
| Native Hawaiian or Pacific Islander | 0.0% (0) | 0.1% (1) | |
| Unknown/Not Reported | 12.9% (23) | 29.4% (236) | |
| Ethnicity | | | <0.0001 |
| Hispanic | 8.4% (15) | 7.3% (59) | |
| Not Hispanic | 83.1% (148) | 69.1% (555) | |
| Unknown | 8.4% (15) | 23.5% (189) | |
| BMI | | | 0.057 |
| <18.5 (Underweight) | 0.0% (0) | 0.1% (1) | |
| 18.5–24.9 (Normal) | 29.2% (52) | 21.4% (170) | |
| 25.0–29.9 (Overweight) | 35.4% (63) | 34.1% (271) | |
| 30 (Obese) | 35.4% (63) | 44.4% (353) | |
| Diabetes | | | |
| No | 92.7% (165) | 92.9% (746) | 0.964 |
| Oral Agents (Non-Insulin) | 5.6% (10) | 5.2% (42) | |
| Insulin | 1.7% (3) | 1.9% (15) | |
| Smoking History | | | |
| Yes | 8.4% (15) | 4.9% (39) | 0.069 |
| No | 91.6% (163) | 95.1% (764) | |
| Dyspnea | | | 1.0000 |
| No | 98.3% (175) | 98.1% (788) | |
| Moderate Exertion | 1.7% (3) | 1.9% (15) | |
| At Rest | 0.0% (0) | 0.0% (0) | |
| Functional Status | | | |
| Independent | 98.9% (176) | 99.8% (801) | 0.153 |

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| | 0–2 days LOS | 3+ days LOS | p-value |
|---|-------------------|------------------|---------|
| Partially Dependent | 1.1% (2) | 0.1% (1) | |
| Totally Dependent | 0.0% (0) | 0.0% (0) | |
| Unknown | 0.0% (0) | 0.1% (1) | |
| Chronic Obstruction Pulmonary Disease | | | 1.000 |
| Yes | 0% (0) | 0.5% (4) | |
| No | 100.0% (178) | 99.5% (799) | |
| Ascites | | | |
| Yes | 0% (0) | 0% (0) | 1.000 |
| No | 100.0% (178) | 100.0% (803) | |
| Congestive Heart Failure | | | 1.000 |
| Yes | 0.0% (0) | 0.1% (1) | |
| No | 100.0% (178) | 99.9% (802) | |
| Hypertension Requiring Medication | | | |
| Yes | 29.8% (53) | 20.8% (167) | 0.013 |
| No | 70.2% (125) | 79.2% (636) | |
| Renal Failure | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (178) | 100.0% (803) | |
| Dialysis | | | 1.000 |
| Yes | 0.0% (0) | 0.0% (0) | |
| No | 100.0% (178) | 100.0% (803) | |
| Steroid Use | | | |
| Yes | 1.1% (2) | 1.9% (15) | 0.752 |
| No | 98.9% (176) | 98.1% (788) | |
| Bleeding Disorders | | | |
| Yes | 0.6% (1) | 0.2% (2) | 0.452 |
| No | 99.4% (177) | 99.8% (801) | |
| ASA Class | | | |
| 1 – Normal health | 3.4% (6) | 4.7% (38) | 0.451 |
| 2 – Mild systemic disease without functional limitations | 61.8% (110) | 60.3% (484) | |
| 3 – Severe systemic disease with some functional limitations | 33.7% (60) | 34.6% (278) | |
| 4 – Severe systemic disease that is a constant threat to life | 1.1% (2) | 0.4% (3) | |
| 5 – Not expected to survive without the operation | 0.0% (0) | 0.0% (0) | |
| Operative Time, minutes | | | <0.0001 |
| Mean, SD | 340.2 (124.797) | 482.6 (162.792) | |
| Median, IQR | 344.5 (243,417.5) | 471 (380,564.75) | |

* Any data which was missing or reported as “NULL” was excluded from the reported distributions

BMI, body mass index; ASA, American Society of Anesthesiologists; SD, standard deviation; IQR, interquartile range

Table 8:

Complications Autologous 0–2 days LOS vs 3+ days LOS

| Complications | 0–2 days LOS | 3+ days LOS | p-value |
|--|--------------|-------------|---------|
| Superficial Surgical Site Infection | 3.9% (7) | 8.3% (67) | 0.042 |
| Deep Surgical Site Infection | 3.4% (6) | 3.6% (29) | 1 |
| Wound Dehiscence/Disruption | 1.7% (3) | 1.9% (15) | 1 |
| Unplanned Intubation | 0.0% (0) | 0.2% (2) | 1 |
| Ventilator Occurrences > 48 hours | 0.0% (0) | 0.2% (2) | 1 |
| Pneumonia | 0.0% (0) | 0.5% (4) | 1 |
| Pulmonary Embolism | 0.0% (0) | 0.2% (2) | 1 |
| Cerebrovascular Accident with deficits (stroke) | 0.0% (0) | 0.1% (1) | 1 |
| Cardiac Arrest with cardiopulmonary resuscitation | 0.0% (0) | 0.0% (0) | 1 |
| Myocardial Infarction (Intra- or Post-operative) | 0.0% (0) | 0.1% (1) | 1 |
| Sepsis | 0.0% (0) | 0.7% (6) | 0.599 |
| Septic Shock | 0.0% (0) | 0.0% (0) | 1 |
| Return to OR for Unplanned Reoperation | 3.9% (7) | 14.7% (118) | <0.001 |
| Unplanned Readmission | 2.2% (4) | 7.5% (60) | 0.007 |
| Unplanned Readmission Related to Primary Procedure | 1.7% (3) | 6.9% (56) | 0.005 |

OR, operating room