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Breast

Postoperative Day 1 Discharge in Deep Inferior Epigastric Artery Perforator Flap Breast Reconstruction

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Background: With high success rates of autologous breast reconstruction, the focus has shifted from flap survival to improved patient outcomes. Historically, a criticism of autologous breast reconstruction has been the length of hospital stay. Our institution has progressively shortened the length of stay after deep inferior epigastric artery perforator (DIEP) flap reconstruction and began discharging select patients on postoperative day 1 (POD1). The purpose of this study was to document our experience with POD1 discharges and to identify preoperative and intraoperative factors that may identify patients as candidates for earlier discharge.

Methods: An institutional review board-approved, retrospective chart review of patients undergoing DIEP flap breast reconstruction from January 2019 to March 2022 at Atrium Health was completed, consisting of 510 patients and 846 DIEP flaps. Patient demographics, medical history, operative course, and postoperative complications were collected.

Results: Twenty-three patients totaling 33 DIEP flaps were discharged on POD1. The POD1 group and the group of all other patients (POD2+) had no difference in age, ASA score, or comorbidities. BMI was significantly lower in the POD1 group (P = 0.039). Overall operative time was significantly lower in the POD1 group, and this remained true when differentiating into unilateral operations (P = 0.023) and bilateral operations (P = 0.01). No major complications occurred in those discharged on POD1.

Conclusions: POD1 discharge after DIEP flap breast reconstruction is safe for select patients. Lower BMI and shorter operative times may be predictive in identifying patients as candidates for earlier discharge. *(Plast Reconstr Surg Glob Open 2023; 11:e5064; doi: 10.1097/GOX.0000000000005064; Published online 14 June 2023.)*

INTRODUCTION

Autologous reconstruction accounts for 19% of all breast reconstruction cases in the United States and is considered the gold standard for reconstruction of the irradiated mastectomy patient.[1,2] The benefits of autologous breast reconstruction have been well described, including lower infection rates, lower reconstructive failure rates, and improved patient-reported sexual and psychosocial well-being compared with implant-based breast reconstruction.[3–5] Primary drawbacks of autologous breast reconstruction include prolonged operative times and hospital stays due to the increased complexity of the procedure.

The deep inferior epigastric artery perforator (DIEP) flap has become the primary autologous option for breast reconstruction.[6] Historically, DIEP breast reconstruction hospital stays could last upward of 1 week, creating a large burden of cost and healthcare resources. This stimulated a need for autologous breast reconstruction enhanced recovery after surgery (ERAS) pathways. Implementation of ERAS protocols decreased length of stay without an increase in postoperative morbidity.[7–11]

Although there is consensus that autologous breast reconstruction hospital stays can be shortened while still maintaining optimal patient care, only one group has described a systematic approach to discharging patients on postoperative day 1 (POD1).[5,12,13] The technique

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utilized to allow for POD1 discharge, which involves microfascial incisional patterns and low utilization of preoperative imaging, may not be applicable to many surgeons.

At our institution, we have progressively shortened our length of stay after DIEP flap reconstruction using reproducible surgical techniques and ERAS-supported protocols and, over the course of the past 3 years, have begun discharging select patients on POD1. The purpose of this study was to review a single-institution experience with POD1 discharges and to identify preoperative and intraoperative factors that are associated with early discharge.

Takeaways

Question: Is postoperative day 1 (POD1) discharge after DIEP flap breast reconstruction safe, and if so, which patients are candidates for POD1 discharge?

Findings: A retrospective review at a single institution identified 23 patients discharged on POD1 across 3 years. Of those discharged on POD1, no major postoperative complications were found. The operative duration was shorter, and BMI was lower compared with that of the POD2+ group.

Meaning: POD1 discharge after DIEP flap breast reconstruction is safe. Operative time and BMI may predict candidates for earlier discharge.

METHODS

An institutional review board approved retrospective review of the electronic medical record at a single institution (Atrium Health, Charlotte, N.C.) was performed. Patients undergoing autologous reconstruction with unilateral or bilateral DIEP flaps from January 2019 to March 2022 were included for retrospective analysis. Exclusion criteria were patients undergoing implant-based breast reconstruction, alternative autologous flaps for breast reconstruction, and patients under the age of 18. Relevant data were extracted from the electronic medical record, collected, and managed using the REDCap (Research Electronic Data Capture) database.[14,15]

Technique

All patients underwent preoperative computed tomography angiography for perforator mapping and were counseled on the importance of early ambulation in the immediate postoperative setting (Fig. 1). A two-surgeon approach was used for most cases, depending on availability of a co-surgeon. For chest vessel exposure, the largest intercostal space was identified by palpation and the costochondral junction was removed for adequate exposure. Abdominal fascial incisions were made as large as necessary to facilitate perforator dissection (Fig. 2). All flaps were anastomosed end-to-end with the antegrade internal mammary artery, and all venous anastomoses were performed with a venous coupler. A skin paddle was left, and flaps were monitored with a transcutaneous oxygen system (ViOptix, Newark, Calif.). All patients received a standard dose of enoxaparin preoperatively.

PostOperative Protocol

After the procedure, patients are monitored in our PACU for 4–6 hours with 1:2 nursing ratio. Patients are given a clear liquid diet and transitioned to PO pain medications once transferred out of the PACU. ViOptix monitoring is used overnight with clinical examinations performed by nursing as needed. On morning rounds POD1, a clinical examination is performed by the senior surgeon. Pending no clinical concerns, ViOptix probes, IV fluids, and foley catheter are all discontinued. Patients are discharged once they ambulate independently, tolerate a

Fig. 1. Predicted location of perforators as aided by preoperative computed tomography angiography.

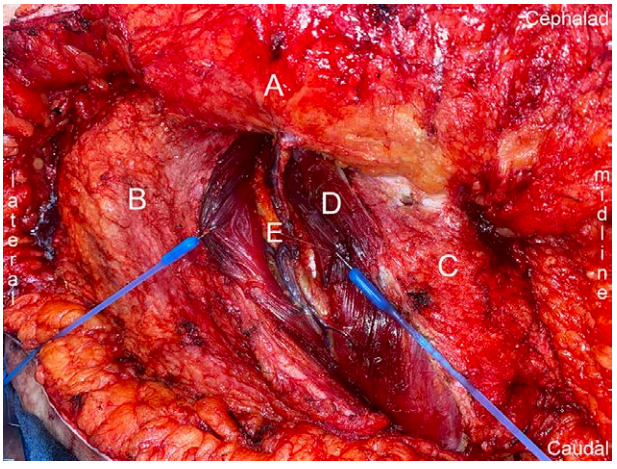

Fig. 2. Deep inferior epigastric perforator dissection with traditional full length fascial incision. A, DIEP Flap with perforator visualized. B, Abdominal wall. C, Anterior rectus sheath. D, Rectus muscle with large overlying anterior rectus sheath incision. E, Deep inferior epigastric artery and vein with perforator penetrating the DIEP flap.

regular diet, and have voiced comfort with going home. All patients receive a standard dose of Lovenox on POD1. Depending on the respective surgeon's preference, patients may or may not be discharged with aspirin. While we teach patients critical aspects of the clinical examination such as capillary refill, flap temperature, and signs of ischemia or venous congestion, we do not instruct patients to perform independent examinations at home. Patients may wear garments that provide comfort and support but are not required to wear breast or abdominal binders. Regarding follow-up, patients are seen at 1 week and again at 4–6 weeks. Typically, breast drains are removed at the first follow-up, and a nurse visit is scheduled by the patient once abdominal drains remain below 25 cm^3/24 hours (typically week 2–3).

Recorded data for patients included demographics, medical history, social history, breast surgical history, oncologic history (including history of radiation and/or chemotherapy), intraoperative factors, postoperative course (including complications), length of stay, subsequent revisionary procedures, and length of follow-up. For the purposes of this study, major complications were defined as total flap failure, vascular compromise (either arterial or venous), and hematoma requiring return to the operating room. Minor complications were defined as seroma, wound dehiscence, infection, fat or skin necrosis, abdominal bulge, hernia, or partial flap loss.

The patients were divided into two groups: the first included patients discharged on postoperative day 1 (POD1), and the second included all other patients (POD2+). Given the unequal sample sizes, Welch two-sample *t* test was used to compare means between the two groups. Fisher exact test for homoscedasticity was used to confirm independent samples were present. All statistical analysis was performed using R statistical software.

RESULTS

In this study, 510 patients were included for a total of 846 DIEP flaps (336 bilateral, 174 unilateral cases). Twenty-three patients (33 flaps) were discharged on POD1, and 487 patients (815 flaps) were discharged on POD 2 or later (POD2+). The POD1 group and POD2+ group had no difference in age, ASA score, or comorbidities (Table 1). There was a statistically significant difference in average BMI, with POD1 being 27.8 (SD = 5.4) versus 30.3 (SD = 5.4) in POD2+.

In the POD1 group, 19 patients were diagnosed with unilateral breast cancer, one had bilateral cancer, and three underwent prophylactic risk-reducing mastectomy. Five patients (21.7%) underwent immediate reconstruction (three unilateral, two bilateral), and 18 patients (78.3%) had delayed reconstruction (12 unilateral, six bilateral; Table 2). In the POD2+ group, 402 patients had unilateral breast cancer, 34 had a history of bilateral breast cancer, and 51 patients had prophylactic risk-reducing mastectomy. Immediate reconstruction was performed in 105 patients (21.6%) (32 unilateral, 73 bilateral), and 381 patients (78.4%) had delayed reconstruction (127 unilateral and 254 bilateral).

POD1 patients had an average operative duration for immediate unilateral cases of 326 minutes (SD = 148), whereas immediate bilateral cases had an average of 389 minutes (SD = 36.8). Delayed unilateral cases had an average operative time of 215.5 minutes (SD = 42.9), and delayed bilateral cases was 325.7 minutes (SD = 102.3). In comparison, POD2+ patients had average operative durations of 363.5 minutes SD = 118.9) for immediate unilateral cases and 514.2 minutes (SD = 134.2) for immediate bilateral cases. The average operative duration of delayed unilateral cases was 276.2 minutes (SD = 89.9) and 437.9 minutes (SD = 127.6) for delayed bilateral reconstruction.

Complications in both POD1 and POD2+ were quantified (Table 3). The average follow-up of those discharged on POD1 was 212.3 days (SD = 175.9), while the average follow-up of POD2+ patients was 309.4 days (SD = 246.4) (P = 0.02). Follow-up was based on date of discharge and date of most recent follow-up appointment. Utilizing Welch two-sample *t* tests, BMI was significantly lower in the POD1 group (P = 0.039). Rates of HTN, COPD, and diabetes were not statistically different, as well as ASA score (P = 0.701). Regarding oncological treatment, there was no difference in rates of radiation or chemotherapy administration (P = 0.84 and 0.28, respectively).

Table 1. Patient Demographic Data

	POD1 Discharge (n = 23)	POD2+ Discharge (n = 487)	*P*
Age, mean	49.6	50.8	0.54
BMI, mean (SD), kg/m^2	27.78 (5.42)	30.3 (5.44)	0.04
ASA score	2.39	2.44	0.70
Comorbidities			
COPD, n (%)	0 (0%)	1 (0.2%)	0.32
HTN, n (%)	5 (22%)	127 (26%)	0.64
Diabetes, n (%)	3 (13%)	37 (7.6%)	0.46
Operative time (min)			
Unilateral	237.6	293.8	0.02
Bilateral	341.5	454.8	0.01
Smoking status (%)			0.02
Current	2 (8.7%)	8 (1.6%)	
Former	4 (17.4%)	154 (31.6%)	
Never	17 (73.9%)	325 (66.7%)	
Radiation (%)	11 (47.8%)	244 (50.1%)	0.83
Chemotherapy (%)	8 (34.7%)	225 (46.2%)	0.28

Table 2. Operative Duration

	POD1 Discharge (n = 23)	POD2+ Discharge (n = 487)	*P*
Immediate unilateral, n, mean (SD), min	N = 3 Mean = 326 (SD = 148.0)	N = 32 Mean = 363.5 (SD = 118.9)	0.70
Immediate bilateral, n, mean (SD), min	N = 2 Mean = 389 (SD = 36.8)	N = 73 Mean = 514.2 (SD = 134.2)	0.061
Delayed unilateral, n, mean (SD), min	N = 12 Mean = 215.5 (SD = 42.9)	N = 127 Mean = 276.2 (SD = 89.9)	<0.001
Delayed bilateral, n, mean (SD), min	N = 6 Mean = 325.7 (SD = 102.3)	N = 254 Mean = 437.9 (SD = 127.6)	0.042

Table 3. All Complications

	POD1 Discharge (n = 23)	POD2+ Discharge (n = 487)	*P*
Hematoma	0	27	<0.001
Seroma	0	30	<0.001
Wound dehiscence	0	45	<0.001
Infection	2	50	0.80
Fat necrosis	1	62	0.079
Skin necrosis	1	30	0.689
Abdominal bulge	0	4	0.045
Hernia	2	3	0.193
Partial flap loss	0	2	0.158
Total flap loss	0	4	0.045
Arterial thrombosis	0	0	NA
Venous congestion	0	14	<0.001

Overall operative time was significantly lower in the POD1 group ($P < 0.001$), and this remained true when differentiating into unilateral operations ($P = 0.023$) and bilateral operations ($P = 0.01$). We further stratified these groups to evaluate the effects of timing on the surgery (immediate versus delayed). There was no statistically significant difference in operative duration between the POD1 and POD2+ groups when comparing immediate reconstructions. However, patients in the POD1 group had statistically significant shorter operative durations than the POD2+ group for delayed reconstructions.

Those discharged on POD2+ were more likely to experience hematomas and seromas ($P < 0.001$). Total flap loss was greater in the POD2+ group ($P = 0.045$), and venous congestion was more commonly experienced as well in the POD2+ cohort ($P < 0.001$). No statistically significant differences were found regarding infection, fat necrosis, or skin necrosis.

DISCUSSION

Microsurgical breast reconstruction has advanced significantly over the last 20 years. With success rates consistently at 97%–98% in major centers, the focus has shifted from flap survival to improved patient outcomes. In 2017, the ERAS society provided breast reconstruction-specific guidelines, which have since been modified for microsurgical reconstruction.[7,16] These ERAS protocols were implemented at our institution, which led the senior author to identify a select group of patients deemed appropriate for discharge as early as POD1. Over the past 3 years, 23 patients undergoing DIEP breast reconstruction at our institution were discharged on POD1.

Our department has implemented a standardized protocol for the pre-, peri-, and postoperative phases of surgery (Fig. 3). In the preoperative phase, our practice routinely obtains preoperative computed tomography angiography for mapping, which has been shown to reduce operative times.[17] We also dedicate time during the

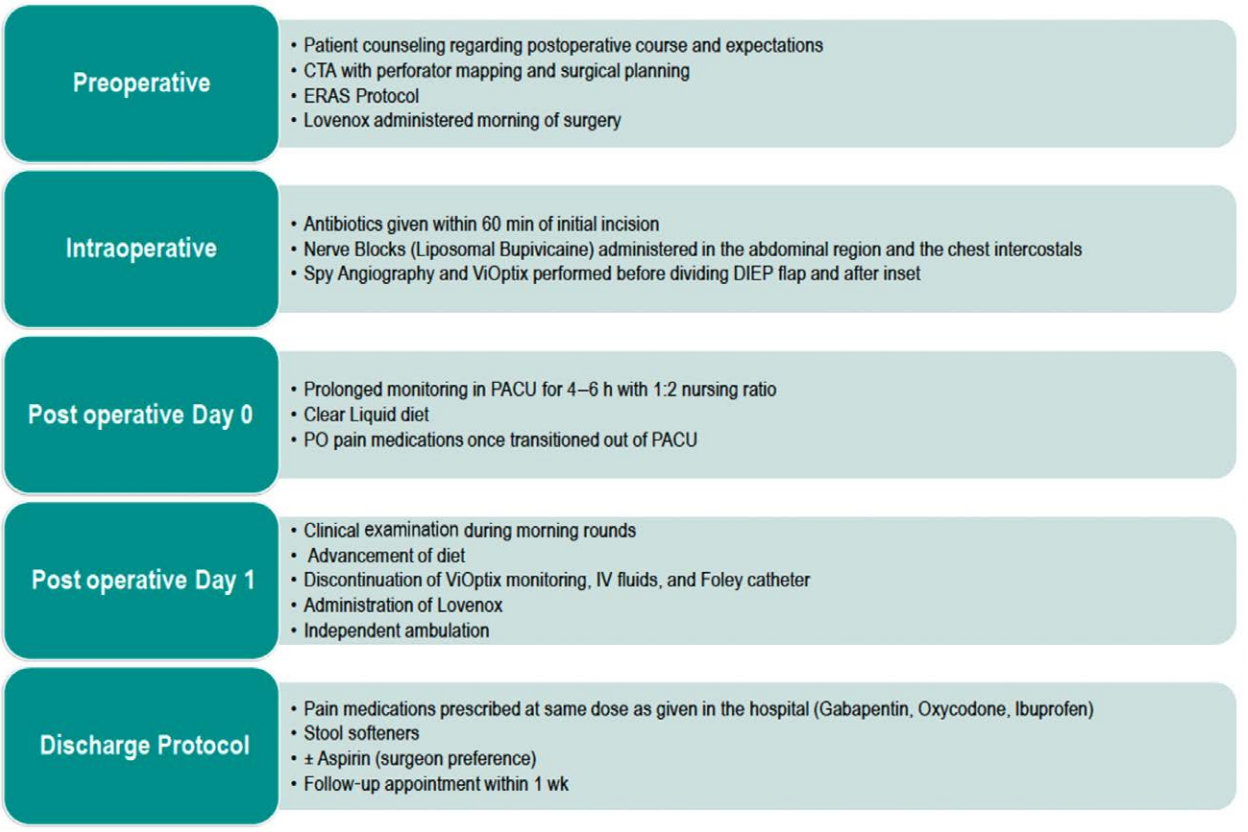

Fig. 3. Preoperative, intraoperative, and postoperative DIEP flap protocol.

preoperative appointment to patient counseling regarding postoperative expectations. Bamba et al reported significantly shorter hospital stays in patients who received preoperative counseling on early discharge when compared with those without counseling.[18] Anecdotally, our senior author has found that patient expectation is the number one factor preventing earlier discharge. Patients often read that they will remain in the hospital for 3–5 days after this procedure, and it is important to re-calibrate their expectations. Specific discussion is tailored towards the patient on a case-by-case basis. Intraoperatively, to optimize postoperative pain control, Exparel is injected by the surgeon into the rectus sheath and the intercostal spaces for both donor site and recipient site analgesia.[19] Prior to 08:00 AM the morning of POD 1, clinical evaluation is performed, and stable flap perfusion is confirmed based on evaluation of flap color, hand-held doppler signal, and ViOptix trend. Normal flap perfusion allows for discontinuation of the ViOptix monitor, urinary catheter, and ancillary IV access, and we begin early ambulation. Patients are discharged once they can void and ambulate independently. Patients are not considered candidates for discharge on POD1 if there are concerns regarding stable flap perfusion.

Shorter operative duration has been associated with decreased perioperative and postoperative risk. One study reported autologous breast reconstruction lasting longer than 6.77 hours doubled the risk of complications.[20] Haddock et al recently reported on the relationship between operative time and postoperative outcomes in a series of 500 patients undergoing bilateral DIEP reconstruction.[21] The authors found that each additional 3.7 hours of operative time predicts an increase of 1 additional day of hospitalization. These findings have been corroborated in the European literature as well, in which efficient surgical techniques in DIEP flap reconstruction led to shorter operative times and fewer complications.[22] Our data support these prior studies, as the overall operative time was significantly lower in the POD1 group, and this remained true when differentiating into unilateral and bilateral operations. However, when stratified by reconstruction timing, there was no significant difference in the immediate unilateral and immediate bilateral groups. Factors that may explain this discrepancy are the small sample size within this subgrouping, limiting the power of our analysis, and the inability for us to separate the oncologic portion from the overall timing of the case.

Complications of microsurgical breast reconstruction can be devastating, including risk of hemorrhage and total flap loss due to vascular compromise.[23] DIEP flaps performed at our institution are monitored using ViOptix T.Ox Tissue oximeter, which has been shown to provide earlier detection of vascular compromise.[24] Monitoring is discontinued by 8:00 AM on POD 1 if no issues have arisen. Baltodano et al proposed discontinuation of monitoring by 24 hours due to the low rate of flap salvage after this period.[25,26] There were no major complications within our POD1 cohort. The increased rate of complications in the POD2+ group is likely due to early diagnosis, and therefore, these patients were not candidates for discharge on POD1.

In 2018, Martinez et al reported their experience, with 14 patients being discharged on POD1.[5] This was possible due to five key concepts: multimodal pain control, microfascial incisions for perforator harvest, preservation of the rib, a standardized anticoagulation regimen, and a double-venous drainage system. While these techniques inherently make sense and may improve patient outcomes, our practice of rib resection and a traditional full-length fascial incision has not impeded POD1 discharge. Furthermore, operative duration was shorter in our cohort, indicating that their concepts may prolong operative time.

There was no difference in patient demographics between the POD1 and POD2+ cohorts regarding age, ASA score, medical comorbidities, preoperative radiation, or preoperative chemotherapy. Results did indicate the POD1 group had a significantly lower BMI (27.8 versus 30.3). Additionally, the difference in smoking status (current, former or never smokers) between the two groups was statistically significant; however, both groups had low rates of current smokers. Regarding BMI, POD1 discharged patients were more likely to be considered overweight (BMI of 25–30) by the World Health Organization parameters. Those discharged on POD2+ were more likely to be obese (BMI greater than 30.0). Our findings support other literature that obese patients typically have longer lengths of stay following operations.[27–30] Per our department policies, we have a BMI limit of 45 and have patients quit smoking 2 months before surgery; we enforce this with nicotine and cotinine labs at the preoperative appointment. Patients indicated as "current smokers" likely represent those patients who were smoking at time of initial consultation.

In this population, the number of POD1 discharges increased in each year of the study period. In the first year, only one patient was discharged on POD1, followed by nine patients in year 2 and 10 patients in year 3. Early collection of year 4 data showed a trend to even more POD1 discharges. This is a logical conclusion: as our surgeons became more comfortable with POD1 discharge, more patients were deemed appropriate. In addition to the importance of patient counseling noted earlier, our senior author also emphasizes the significance of having a large experience with DIEP flaps. In his own practice, he notes that experience leads to additional comfort with all aspects of the microsurgical procedure, but his greatest strides are evidenced by his approach to the dissection of the abdominal perforators. Through recognizing perforator patterns, utilizing a large fascial incision and performing most of the dissection with bipolar electrocautery, he has greatly increased the efficiency of the dissection and, therefore, the operation as a whole. Future studies and modifications to our current protocol could include earlier discontinuation of urinary catheterization immediately following the procedure or after PACU stabilization. This may lead to earlier ambulation and allow for a greater number of POD1 discharges.

Limitations in our study to consider include a small population of patients discharged on POD1 and the

retrospective nature of the study. Also, all patients were cared for by a single institution and surgical group. Further prospective studies with a large sample size are needed, and validated patient surveys would add patient perspective regarding earlier discharge. Currently, patient feedback has been overwhelmingly positive, but is anecdotal in nature.

CONCLUSIONS

In appropriately selected DIEP flap breast reconstruction patients, discharge on POD1 is both possible and safe. Earlier discharge has numerous benefits for patients and may play a significant role when counseling patients on breast reconstruction options. A lower patient BMI and shorter operative times may be indicative of potential POD1 discharge patients. Additionally, POD1 discharge would increase the feasibility of cosmetic DIEP breast reconstruction in patients hoping to avoid implants.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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