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Breast

Pushing the DIEP Envelope with ERAS: 24 Hour Discharge is Safe in Appropriately Selected Patients

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Background: Enhanced recovery after surgery protocols have become increasingly adopted for autologous breast reconstruction, demonstrating improved quality of care and reduced hospital stays. Despite this, average length of stay remains over 3 days. We have found, in appropriately selected patients, hospital length of stay can be safely reduced to less than 48 hours.

Methods: Retrospective review was performed of patients who underwent microsurgical breast reconstruction by the senior author (M.H.) from April 2019 to December 2021. Demographics, operative details, length of stay, and postoperative complications are reported to assess for safety of discharge within 48 hours, with the primary outcome measure being flap loss.

Results: In total, 188 flaps were performed on 107 patients. Average age was 51.4 years (SD 10.1 years) with average BMI 26.6 kg/m^2 (SD 4.8 kg/m^2). Average length of stay was 1.97 days (SD 0.61 days), and 96 patients (89.7%) were discharged within 48 hours. Six flaps (3.2%) required operative takebacks. Five of the six (83.3%) takebacks occurred on postoperative days zero or one, and all five of these flaps were salvaged. There were four breast hematomas (2.1%), four breast seromas (2.1%), eight breast infections (4.3%), 13 breasts (6.9%) with wound dehiscence, four flaps (2.1%) with partial flap loss, and 24 breasts (12.8%) with mastectomy flap necrosis. One hundred fifty flaps (79.8%) had no complications. Overall success rate of flap reconstruction was 99.5%.

Conclusion: Hospital discharge in 24–48 hours is safe in appropriately selected patients undergoing autologous tissue breast reconstruction. *(Plast Reconstr Surg Glob Open 2023; 11:e5070; doi: 10.1097/GOX.0000000000005070; Published online 30 June 2023.)*

INTRODUCTION

Over the past 20 years, efforts have focused on improving the perioperative recovery experience for patients. Efforts both in the operating room (ie, prophylactic antibiotics, maintaining normothermia, shortening operative times) and after the procedure (ie, multimodal analgesia, early nutrition, nausea prevention, early ambulation) have been shown to reduce complications and expedite recovery time.[1] These combined efforts are known as enhanced recovery after surgery (ERAS) to signify the protocolization of these pathways in surgery. ERAS was initially described in other surgical specialties and only more recently has become adopted by plastic surgery.[1–3] Not only have ERAS pathways been shown to improve quality of care, but they also reduce healthcare costs.[4]

ERAS protocols are increasingly being adopted, specifically for the perioperative care of autologous tissue breast reconstruction.[5–8] Adoption of these protocols simplifies and ensures certain aspects of the patient recovery process, making it possible to avoid ICU admissions and reduce hospital length of stay.[9] Furthermore, in the setting of the COVID-19 pandemic, any efforts to reduce hospital length of stay and free up ICU resources is beneficial. While ERAS protocols have been shown to definitively reduce the hospital length of stay compared with standard protocols, most ERAS protocols still report an average length of stay of 3–4 days for autologous breast reconstruction.[7] A recent analysis of the National Surgical Quality Improvement Program database found a reduction in the average hospital length of stay after microvascular breast reconstruction between 2012 and 2018, without

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any concomitant increase in complications or readmission rates.[10] Despite the reduction, average length of stay in 2018 was still 3.9 days (down from 4.47 days in 2012).[10]

Interestingly, consensus recommendations for most ERAS protocols remain the same for postoperative days 2, 3, and beyond.[5] In other words, the patient's care does not change after postoperative day 1, and care instructions remain the same until their 1 week follow-up appointment (ie, continue the same diet, same pain regimen, same stool softener, same antiemetic, same DVT prophylaxis, and same activity restrictions). As such, there does not seem to be a strong reason to keep the patient confined to the hospital (beyond flap monitoring reasons), especially with all the associated costs for a recovery that could otherwise be done at the patient's home.

We hypothesized that appropriately selected patients (healthy patients with limited comorbidities) can be successfully discharged from the hospital by postoperative day 2 without affecting recovery or outcomes. With our ERAS protocol, in the appropriately selected patient, we have been able to reduce hospital length of stay to 24–48 hours. The goal of this article is to describe our ERAS experience with hospital discharge on postoperative day 1 or 2. We demonstrate that intensive care unit resources and prolonged flap monitoring are unnecessary to successful outcomes in free flap breast reconstruction. Secondarily, we compare patients who were successfully discharged within 48 hours to those requiring a longer length of stay.

Takeaways

Question: With standardization of enhanced recovery after surgery protocols, can patients be safely discharged in 24–48 hours after free flap breast reconstruction?

Findings: Ninety-six of 107 patients (89.7%) were discharged within 48 hours. Flap survival rate was 99.5%. Longer hospital stay was more often required in older patients and those undergoing immediate reconstruction.

Meaning: Enhanced recovery after surgery pathways help expedite recovery after free flap breast reconstruction. Hospital discharge in 24–48 hours is safe and effective in appropriately selected patients.

METHODS

After institutional review board approval (IRB protocol #STU00216356), retrospective chart review of a prospectively collected database was performed of a consecutive series of patients who underwent free flap breast reconstruction at Northwestern Lake Forest Hospital by the senior surgeon (MH) between April 2019 and December 2021. The senior author prefers DIEP flap breast reconstruction over implant-based reconstruction in appropriate surgical candidates. Patients who are active smokers, with BMI over 35 kg/m^2, or with significant comorbidities (American Society of Anesthesiologists class III or IV) are not considered candidates for DIEP flap reconstruction. Data collected included demographics (age, body mass index, medical comorbidities, cancer history), operative details (donor site, laterality, recipient vessels, operative time), postoperative complications (hematoma, seroma, infection, wound dehiscence, partial flap necrosis, need for operative takeback, anastomotic revision, flap failure), and time to hospital discharge. Hematomas and seromas were defined as fluid collections that required drainage (either in the operating room or in clinic). An infection was defined as any clinical signs or symptoms that required antibiotics with or without an incision and drainage. Wound dehiscence was defined as any wound that required debridement and dressing changes or re-closure at a later date. Flap necrosis was defined as any patient who required any degree of debridement of mastectomy flap, DIEP flap, or abdominal skin flap/incision closure. Patients were deemed ready for hospital discharge when they were tolerating a regular diet, ambulating, and had pain adequately controlled with oral medications.

All patients were cared for under our ERAS protocol (Fig. 1). Our protocol begins at the preoperative clinic visit with expectation setting, which includes descriptions of the surgery, expected length of stay, and a realistic recovery pathway. On the morning of surgery, patients are given a carbohydrate drink two hours prior to surgery. Anesthesia is optimized with ultrasound guided transversus abdominus plane blocks on all patients and pectoralis (PEC) I and II blocks in immediate reconstruction patients. Blocks consist of 0.25% bupivacaine with epinephrine 1:300,000 and are dosed by weight. Normothermia is targeted with both underbody and lower body forced-air warmers intraoperatively. A relatively restrictive fluid regimen with lactated ringers (3–5 cm^3/kg/h) is utilized; however, fluid management is dynamic and targets adequate mean arterial pressures and urine outputs (> 0.5 cm^3/kg/h). Colloid fluids (albumin) are bolused as needed to help avoid vasopressors. General

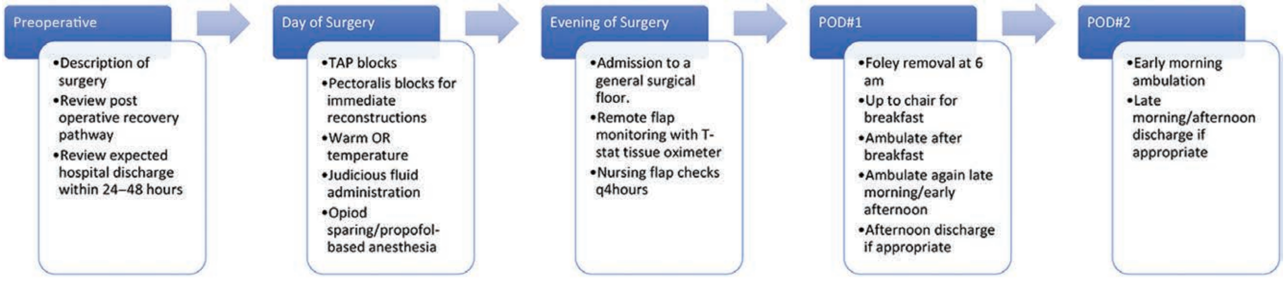

Fig. 1. Enhanced recovery after surgery standard pathway.

anesthesia is maintained with concurrent use of a volatile anesthetic and a propofol infusion.

Postoperatively, patients are admitted to a routine medical/surgical inpatient ward and flaps are monitored with the T-stat (Spectros Medical Devices, Houston, TX; https://www.spectros.com) tissue oximeter. This allows for remote monitoring that is accessible on the surgeon's cell phone. Nurses are also trained to perform flap checks every 2 hours by visual color inspection, flap warmth, and flap turgor. Patients are given clear liquids the night of surgery and scheduled nonnarcotic pain medications commence. On postoperative day 1, the foley catheter is removed, patients are moved from the bed to the chair for breakfast, and then encouraged to ambulate immediately after breakfast, as well as again in the late morning and afternoon. Patients are evaluated for readiness for discharge in the afternoon on postoperative day 1. If not ready, patients are again evaluated the morning of postoperative day 2. When ready for discharge, flap monitors are removed, and the patient is instructed to shower before discharge. Pain medications include scheduled nonsteroidal antiinflammatory drugs/acetaminophen/gabapentin, and muscle relaxants/tramadol as needed. Narcotics are a fifth line option for pain control. Patients are sent home with deep venous thrombosis prophylaxis as indicated based on individual risk assessment.

Postoperative follow-up occurs 1 week after discharge. Our team consists of an advanced nurse practitioner and two physician assistants who help field patient calls from home after discharge. We have found most home calls can be anticipated and prevented with appropriate education at the preoperative counseling appointment and during the hospital stay. This also helps patients feel ready for discharge by postoperative day 1 or 2. Patients are strongly encouraged to have adequate social support at home for the first two weeks after surgery.

Descriptive statistics were performed with mean and standard deviation. The total number and percent of patients with medical comorbidities, as well as intraoperative and postoperative complications, were summarized. Normality of data was determined with the Kolmogorov-Smirnov test. Age and operative time were normally distributed, while BMI was not normally distributed. Subgroups of patients were compared via unpaired *t* test (normally distributed, continuous data), Mann-Whitney *U* test (not normally distributed, continuous data), or Fisher exact test (categorical data).

RESULTS

In total, 188 flaps were performed on 107 patients for autologous tissue breast reconstruction. All flaps were based on the deep inferior epigastric perforators and the internal mammary vessels were the recipient vessels in all cases. Average patient age was 51.4 years (SD 10.1 years) with an average BMI of 26.6 kg/m^2 (SD 4.8 kg/m^2). Patients were relatively healthy, with 16 patients (15.0%) with hypertension, eight patients (7.5%) with diabetes, two patients (1.9%) with coronary artery disease, three patients (2.8%) on immunosuppression, and five patients (4.7%) with a history of coagulopathy. Thirty-six patients (33.6%) were former smokers, and there were no active smokers. Forty-three patients (40.2%) had pre- or postoperative chemotherapy, and 33 breasts (17.6%) had pre- or postoperative radiation. Mastectomy was performed for cancer in 115 flaps (61.2%) and for risk reduction in 73 flaps (38.8%). Reconstruction was immediate in 103 flaps (54.8%). Average follow-up was 317 days (SD 215 days). Demographics are summarized in Table 1.

With regard to hospital course, average operative time was 526 minutes (SD 115 minutes). No patients required ICU-level care postoperatively. The average length of stay was 1.97 days (SD 0.61 days). Length of stay was 1 day for 17 patients (15.9%), 2 days for 79 patients (73.8%), 3 days for nine patients (8.4%), 4 days for one patient (0.9%), and 5 days for one patient (0.9%). Eleven patients (10.3%) stayed more than 48 hours. Reasons for stay more than 48 hours included ongoing pain control (three patients), postoperative hypotension (two patients), intraoperative pneumothorax (one patient), and flap takeback resulting in extended stay for flap monitoring (five patients). The 11 patients with a hospital length of stay greater than 2 days were significantly older (57.4 years versus 50.7 years) and more often underwent immediate reconstruction at the time of mastectomy (84.2% versus 51.5%). There were otherwise no differences between these patients, and those who were discharged in less than two days with regard to BMI, comorbidities, smoking history, laterality of reconstruction, chemotherapy or radiation history, or indication for mastectomy (Table 2). Comparing patients who were discharged in less than 24 hours (n = 17) versus greater than 24 hours (n = 90), there were no differences in demographics, comorbidities, or cancer treatment.

With regard to flap-specific vascular complications, there were six flaps (3.2%) with an operative takeback, and one total flap loss (0.5%). Of the six flaps with an operative takeback, five (83.3%) were salvaged. One flap was taken back in the immediate postoperative period (on postoperative day 0) and was found to have a venous kink that was successfully revised. Four of the flaps were taken back on postoperative day 1. Three of

Table 1. Demographics

Total patients	107
Total flaps	188
Age	51.4 y (SD 10.1 y)
BMI	26.6 kg/m^2 (SD 4.8 kg/m^2)
Hypertension	16 patients (15.0%)
Diabetes	8 patients (7.5%)
Coronary artery disease	2 patients (1.9%)
Coagulopathy	5 patients (4.7%)
Immunosuppressed	3 patients (2.8%)
Former smoker	36 patients (33.6%)
Reconstruction laterality	
Unilateral	26 patients (24.3%)
Bilateral	81 patients (75.7%)
Mastectomy indication	
Breast cancer	115 breasts (61.2%)
Risk reduction	73 breasts (38.8%)
Radiation history	33 breasts (17.6%)
Chemotherapy history	43 patients (40.2%)

Table 2. Comparison between Patients with Hospital Length of Stay Less Than Versus Greater Than Two Days

	LOS ≤ 2 d	LOS > 2 d	*P*
Patients	96	11	n/a
Flaps	169	19	n/a
Age (SD)	50.7 y (10.1 y)	57.4 y (8.4 y)	0.04*
BMI (SD)†	26.3 kg/m^2 (4.4 kg/m^2)	28.9 kg/m^2 (7.3 kg/m^2)	0.25
Hypertension	13 patients (13.5%)	3 patients (27.3%)	0.36
Diabetes	6 patients (6.3%)	2 patients (18.2%)	0.19
Coronary artery disease	2 patients (2.1%)	0 patients (0%)	1.0
Coagulopathy	4 patients (4.2%)	1 patient (9.1%)	0.43
Immunosuppressed	3 patients (3.1%)	0 patients (0%)	1.0
Any comorbidity	23 patients (24.0%)	4 patients (36.4%)	0.46
Former smoker	30 patients (31.3%)	6 patients (54.5%)	0.18
Reconstruction laterality			
Unilateral	23 patients (24.0%)	2 patients (18.2%)	1.0
Bilateral	73 patients (76.0%)	9 patients (81.8%)	
Timing			
Immediate	87 flaps (51.5%)	16 flaps (84.2%)	0.007*
Delayed	82 flaps (48.5%)	3 flaps (15.8%)	
Mastectomy indication			
Breast cancer	100 flaps (59.2%)	15 flaps (78.9%)	0.14
Risk reduction	69 flaps (40.8%)	4 flaps (21.1%)	
Radiation history	30 flaps (17.8%)	3 flaps (15.8%)	1.0
Chemotherapy history	40 patients (41.7%)	3 patients (27.3%)	0.57
Length of surgery (SD)	521 min (115 min)	575 min (116 min)	0.14

*$P < 0.05$.
†Nonparametric data, Mann-Whitney *U* test performed.

these had venous clot likely related to pedicle kink or twist and all were successfully revised. One of these had swelling due to a seroma and no issues with the vascular anastomosis. The one flap that was lost presented with flap loss in delayed fashion, on postoperative day 6 while at home, with venous thrombosis likely due to possible mechanical compression of the pedicle in a patient with a previously unrecognized hypercoagulable state.

With regard to other postoperative complications, there were four breast hematomas (2.1%), four breast seromas (2.1%), eight breast infections (4.3%), 13 breasts with wound dehiscence (6.9%), four flaps with partial flap loss (2.1%), two pulmonary embolisms (1.9%), and 24 breasts with mastectomy flap necrosis (12.8%). Of the four hematomas, one was discovered on postoperative day 1 and contributed to a venous kink/clot that was successfully revised in the operating room. This patient received a blood transfusion. The other three hematomas were minor, occurred in delayed fashion (>2 weeks from surgery), and were successfully managed with evacuation either in the clinic procedure room or in the operating room. None of these three patients required transfusion. Two patients required readmission prior to their follow-up appointment. Both of these readmissions were for treatment of pulmonary embolism.

One hundred fifty flaps (79.8%) had no complications. Overall flap success rate was 99.5%. Complications are summarized in Table 3. Comparison of complications between immediate and delayed reconstructions are summarized in Table 4.

Table 3. Complications

Complication	No. Flaps (%)
Hematoma	4 (2.1%)
Seroma	4 (2.1%)
Infection	8 (4.3%)
Wound dehiscence	13 (6.9%)
Mastectomy flap necrosis	24 (12.8%)
Partial flap loss	4 (2.1%)
Operative takeback	6 (3.2%)
Total flap loss	1 (0.5%)

DISCUSSION

ERAS protocols were first described in general surgery as a means to expedite patient recovery and improve the quality of patient care in the perioperative period.[11] ERAS protocols focus on reducing the perioperative stress response through multimodal approaches, including changes to surgical technique (i.e. minimally invasive surgery), optimizing fluid administration, minimizing anesthesia complications, early feeding, early ambulation, and reduced narcotic administration while controlling pain through multimodal analgesia.[12–14] Through targeting these various components of the perioperative experience, patient morbidity has been reduced, and likewise, hospital length of stay has decreased.[15,16] As a bonus, this has lead to healthcare cost savings.[4]

With demonstrated improvements in the recovery experience, ERAS protocols are being increasingly adopted into plastic surgery. Autologous breast reconstruction rates have increased over the past decade, coinciding with increased pressure to conserve healthcare costs.[17] ERAS in

Table 4. Complications in Immediate versus Delayed Reconstructions

Complication	Immediate (n = 103)	Delayed (n = 85)	*P*
Hematoma	3 (2.9%)	1 (1.2%)	0.63
Seroma	3 (2.9%)	1 (1.2%)	0.63
Infection	7 (6.8%)	1 (1.2%)	0.07
Wound dehiscence	9 (8.7%)	4 (4.7%)	0.39
Mastectomy flap necrosis	22 (21.4%)	2 (2.4%)	<0.001*
Partial flap loss	1 (1.0%)	3 (3.5%)	0.33
Operative takeback	5 (4.9%)	1 (1.2%)	0.22
Total flap loss	1 (1.0%)	0 (0%)	1.0
Length of stay	2.08 days (SD 0.71)	1.87 days (SD 0.43)	0.02*

*$P < 0.05$.

breast reconstruction has therefore been widely adopted as a quality improvement initiatve.[7] In microsurgical breast reconstruction, ERAS protocols have been demonstrated to reduce average hospital length of stay by more than 1 day without impacting 30-day morbidity or flap loss rates.[8] Even so, the average length of stay most recently reported with ERAS protocols remains around 3–4 days.[7] Despite this, consensus recommendations that have been developed for ERAS after autologous tissue breast reconstruction indicate that all changes to the patient's postoperative care occur on postoperative days 1 and 2. After the first 48 hours, all care recommendations (diet, ambulation, DVT prophylaxis, pain control, drain management, and wound care) remain the same until the patient's follow-up appointment. As such, there is relatively little indication to keep patients after 48 hours for flap monitoring purposes alone, if the patient's pain is controlled and they are tolerating regular diet and ambulating. Moreover, patients undergoing autologous tissue breast reconstruction are often relatively healthy with few comorbidities.

Given these considerations, the senior author developed an ERAS protocol that allowed for hospital discharge in 24–48 hours in appropriately selected patients undergoing autologous tissue reconstruction. Our protocol begins at the preoperative visit with expectation setting. Patients are informed at this visit that they will be expected to ambulate the morning of postoperative day 1, and that they can go home as early as the afternoon of postoperative day 1 if they are tolerating a diet and their pain is adequately controlled. Our pathway also admits patients directly to a general surgical ward, rather than relying on ICU level care, which can slow down the discharge process due to the necessity of gradually "stepping down" the patients' level of care. We have found that ICU-level monitoring is unnecessary with the T-stat monitor, which had a 100% success rate at picking up early vascular compromise in our cohort of patients. This technology allowed us to salvage 100% of the flap takebacks occurring during hospital stay. The one flap that presented with flap compromise on postoperative day 6 was a time point at which most patients are home and discharged from the hospital in standard protocols. Most flap compromise occurs in the first 24 hours. Flap loss that occurs in delayed fashion (after postoperative day 3) is less likely to be salvaged, regardless of monitoring.[18,19] This is supported in the literature, as well as in our series where five of the six takebacks (salvaged flaps) occurred within 24 hours. In the single late flap failure case, the patient was an intelligent executive who monitored her flap skin paddle at home. She noticed an acute change in the flap feel and color on postoperative day 6 and quickly notified the surgeon. We believe, based on her description of events, this represented an acute event rather than an unrecognized failing flap in the preceeding days. As such, we do not believe discharge on day 3 or 4 would have altered the outcome in her case. Likewise, we do not feel this constitutes a compelling reason to keep patients in the hospital for monitoring beyond the first 24 hours, nor is it cost effective.

Based on our series, appropriate patients for early discharge include those who are younger (the average age of patients discharged by postoperative day 2 was 50 years), have few comorbidities, and are undergoing delayed reconstruction. Patients undergoing immediate reconstruction may still be candidates for early discharge, but with the understanding that some of them are more likely to require a longer stay for pain control.

Early hospital discharge in appropriately selected patients, and avoiding ICU-level care, potentially translates to significant institutional cost-savings. This is particularly critical in the era of COVID-19 where ICU bed shortages have been experienced and semielective procedures (such as breast reconstruction) have been placed on hold due to staffing shortages as well. One group found that following an ERAS protocol for microsurgical breast reconstruction translated to almost $5000 in healthcare cost savings compared with standard pathways.[4] This study analyzed costs between 2010 and 2014, so that number is likely to be higher today. With over 25,000 microsurgical breast reconstructions performed in 2020, that number could translate to over $125 million in healthcare cost savings nationally for microsurgical breast reconstruction alone.[20]

Strengths of this article include consistency in our ERAS pathway, given all care was administered by the same surgical team, and collection of data in a prospective manner. Limitations include lack of a comparison control group and the fact that outcomes were limited to a single surgeon experience. Additionally, our patient cohort tended to be a relatively healthy population, and thus, our experience may not apply to patients with more comorbidities, as can be seen at tertiary care centers. We also appreciate that in some patients, the risk of flap loss after 24–48 hours still outweighs the benefit of early discharge, and that this risk/benefit ratio must be carefully assessed for each patient. Future work should determine the extent to which our ERAS pathway can contribute to cost savings.

CONCLUSIONS

ERAS pathways are becoming increasingly adopted in microsurgical breast reconstruction. Such pathways improve the perioperative recovery experience, shorten hospital length of stay, and contribute to healthcare cost savings. We have continued to push the ERAS envelope by showing that early hospital discharge in 24–48 hours is safe in the appropriately selected patient. Overall, we feel the key to early discharge is system design. This involves multifaceted planning across the health care system: preoperative expectation setting, medication and postoperative care planning, uncomplicated surgery, anesthesia optimization, and postoperative care simplification. By keying in on each of these areas, all facets of the surgical process are designed for efficiency, simplicity, and to optimize outcomes.

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DISCLOSURE

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

REFERENCES

1. Stowers M, Manuopangai L, Hill A, et al. Enhanced recovery after surgery in elective hip and knee arthroplasty reduces length of hospital stay. *ANZ J Surg.* 2016;86:475–479.
2. Myriokefalitaki E, Smith M, Ahmed AS. Implementation of enhanced recovery after surgery (ERAS) in gynaecological oncology. *Arch Gynecol Obstet.* 2016;294:137–143.
3. Siotos C, Stergios K, Naska A, et al. The impact of fast track protocols in upper gastrointestinal surgery: a meta-analysis of observational studies. *Surgeon.* 2018;16:183–192.
4. Oh C, Moriarty J, Borah BJ, et al. Cost analysis of enhanced recovery after surgery in microvascular breast reconstruction. *J Plast Reconstr Aesthet Surg.* 2018;71:819–826.
5. Stone JP, Siotos C, Sarmiento S, et al. Implementing our microsurgical breast reconstruction enhanced recovery after surgery pathway: consensus obstacles and recommendations. *Plast Reconstr Surg Glob Open.* 2019;7:e1855.
6. Afonso A, Oskar S, Tan KS, et al. Is enhanced recovery the new standard of care in microsurgical breast reconstruction? *Plast Reconstr Surg.* 2017;139:1053–1061.
7. Offodile AC, 2nd, Gu C, Boukovalas S, et al. Enhanced recovery after surgery (ERAS) pathways in breast reconstruction: systematic review and meta-analysis of the literature. *Breast Cancer Res Treat.* 2019;173:65–77.
8. Sebai ME, Siotos C, Payne RM, et al. Enhanced recovery after surgery pathway for microsurgical breast reconstruction: a systematic review and meta-analysis. *Plast Reconstr Surg.* 2019;143:655–666.
9. Gort N, van Gaal BGI, Tielemans HJP, et al. Positive effects of the enhanced recovery after surgery (ERAS) protocol in DIEP flap breast reconstruction. *Breast.* 2021;60:53–57.
10. Holoyda KA, Magno-Padron DA, Carter GC, et al. National trends in length of stay for microvascular breast reconstruction: an evaluation of 10,465 cases using the american college of surgeons national surgical quality improvement program database. *Plast Reconstr Surg.* 2022;149:306–313.
11. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth.* 1997;78:606–617.
12. Adamina M, Kehlet H, Tomlinson GA, et al. Enhanced recovery pathways optimize health outcomes and resource utilization: a meta-analysis of randomized controlled trials in colorectal surgery. *Surgery.* 2011;149:830–840.
13. Kehlet H, Wilmore DW. Multimodal strategies to improve surgical outcome. *Am J Surg.* 2002;183:630–641.
14. Kehlet H, Slim K. The future of fast-track surgery. *Br J Surg.* 2012;99:1025–1026.
15. Greco M, Capretti G, Beretta L, et al. Enhanced recovery program in colorectal surgery: a meta-analysis of randomized controlled trials. *World J Surg.* 2014;38:1531–1541.
16. Gustafsson UO, Hausel J, Thorell A, et al; Enhanced Recovery After Surgery Study Group. Adherence to the enhanced recovery after surgery protocol and outcomes after colorectal cancer surgery. *Arch Surg.* 2011;146:571–577.
17. Masoomi H, Hanson SE, Clemens MW, et al. Autologous breast reconstruction trends in the united states: using the nationwide inpatient sample database. *Ann Plast Surg.* 2021;87:242–247.
18. Kroll SS, Schusterman MA, Reece GP, et al. Timing of pedicle thrombosis and flap loss after free-tissue transfer. *Plast Reconstr Surg.* 1996;98:1230–1233.
19. Chen KT, Mardini S, Chuang DC, et al. Timing of presentation of the first signs of vascular compromise dictates the salvage outcome of free flap transfers. *Plast Reconstr Surg.* 2007;120:187–195.
20. American Society of Plastic Surgeons. Plastic Surgery Statistics Report. 2020. Available at https://www.plasticsurgery.org/documents/News/Statistics/2020/plastic-surgery-statistics-full-report-2020.pdf. Accessed July 13, 2022.