Enhanced Recovery After Surgery (ERAS) Protocol Enables Safe Same-Day Discharge After Alloplastic Breast Reconstruction

La chirurgie d'un jour sécuritaire grâce au protocole de récupération rapide après la chirurgie (RRAC) de reconstruction mammaire alloplastique

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Abstract

Background: To compare enhanced recovery after surgery (ERAS) with traditional recovery after surgery (TRAS) for patients undergoing alloplastic breast reconstruction. **Methods:** A retrospective chart review of 2 patient groups (ERAS and TRAS) undergoing alloplastic breast reconstruction was performed. Data were collected from 2012 to 2013 (TRAS) and from 2013 to 2016 (ERAS). The ERAS protocol included day surgery, multimodal analgesia, and preoperative anti-emetic. The TRAS pathway involved overnight admission, narcotic-based analgesia, and no preoperative anti-emetic. Demographics, operative variables, and complications were compared between groups. **Results:** Seventy-eight ERAS patients and 78 TRAS patients were included. Length of stay was shorter for ERAS patients (0.38 nights ERAS and 1.45 nights TRAS; $P < .001$). The ERAS patients underwent significantly more bilateral surgery (80.8% ERAS and 55.1% TRAS; $P < .001$), immediate reconstruction (98.6% ERAS and 89.3% TRAS; $P = .004$), and had more implants versus expanders placed (66% [93/141] ERAS and 24.8% TRAS; $P < .001$). There were no differences in the number of post-operative emergency department visits (8% ERAS and 14% TRAS; $P = .2$) and readmissions (8% ERAS and 3.8% TRAS; $P = .3$) between the groups. There was no difference in the rate of hematoma (0.7% ERAS and 0% TRAS; $P = .35$), infection requiring explantation (1.4% ERAS and 0.8% TRAS; $P = .65$), infection requiring outpatient IV antibiotics (1.4% ERAS and 2.5% TRAS; $P = .53$), and infection requiring IV antibiotics and readmission (2.1% ERAS and 1.7% TRAS; $P = .78$) between the groups. There were no differences in the number of minor complications (22% ERAS and 23% TRAS; $P = .82$). **Conclusion:** The ERAS protocol for alloplastic breast reconstruction is safe, without increased readmission or complication rates compared to TRAS, and significantly decreased length of stay.

Résumé

Historique : Comparer la récupération rapide après la chirurgie (RRAC) à la récupération habituelle après la chirurgie (RHAC) chez les patientes qui subissent une récupération mammaire alloplastique. **Méthodologie :** Les chercheurs ont procédé à l'analyse rétrospective des dossiers de deux groupes de patientes (RRAC et RHAC) qui subissaient une reconstruction mammaire alloplastique. Ils ont recueilli les données de 2012 et 2013 (RHAC) et de 2013 à 2016 (RRAC). Le protocole RRAC incluait une chirurgie d'un jour, une analgésie multimodale et un anti-émétique préopératoire. La voie RHAC incluait l'admission d'une nuit,

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une analgésie narcotique et l'absence d'anti-émétique préopératoire. Les chercheurs ont comparé les données démographiques, les variables opératoires et les complications entre les groupes. **Résultats :** Au total, 78 patientes RRAC et 78 patientes RHAC ont participé à l'étude. Les patientes RRAC étaient hospitalisées moins longtemps (0,38 nuit RRAC, 1,45 nuit RHAC, $p<0,001$). Les patientes RRAC ont subi beaucoup plus de chirurgies bilatérales (80,8 % RRAC, 55,1 % RHAC, $p<0,001$) et de reconstructions immédiates (98,6 % RRAC, 89,3 % RHAC, $p=0,004$) et se sont fait installer plus d'implants que d'expansurs (66 % RRAC [93 sur 141], 24,8 % RHAC, $p<0,001$). Les groupes ne présentaient pas de différence quant au nombre de rendez-vous postopératoires à l'urgence (8 % RRAC, 14 % RHAC, $p=0,2$) et de réhospitalisations (8 % RRAC, 3,8 % RHAC, $p=0,3$). Ils ne présentaient pas de différences quant au taux d'hématomes (0,7 % RRAC, 0 % RHAC, $p=0,35$) ni d'infection exigeant l'explantation (1,4 % RRAC, 0,8 % RHAC, $p=0,65$), la prise d'antibiotiques IV ambulatoires (1,4 % RRAC, 2,5 % RHAC, $p=0,53$) ou la prise d'antibiotiques IV et une réhospitalisation (2,1 % RRAC, 1,7 % RHAC, $p=0,78$). Le nombre de complications mineures ne différait pas davantage (22 % RRAC, 23 % RHAC, $p=0,82$). **Conclusion :** Le protocole RRAC de reconstruction mammaire alloplastique est sécuritaire, n'accroît pas le taux de réhospitalisations ou de complications par rapport à la RHAC et réduit le séjour hospitalier de manière significative.

Keywords

ambulatory surgical procedures, breast reconstruction, enhanced recovery after surgery, mammaplasty, mastectomy, perioperative care, retrospective studies

Introduction

Enhanced recovery after surgery (ERAS) protocols have been used increasingly since the foundation of the ERAS society in 2010 (www.erassociety.org). These are evidence-guided perioperative protocols that focus on key elements that improve patient recovery, such as perioperative counseling, decreased preoperative fasting, anti-emetic prophylaxis, and multimodal analgesia. The ERAS protocols have been implemented with great success in multiple surgical fields¹⁻⁸ but only recently a protocol has been developed for the breast reconstruction population.⁹ Temple-Oberle et al¹⁰ demonstrated the need for improved recovery in this patient population, as although women were found to rank their satisfaction highly across many domains on the BRECON-31 scale following breast reconstruction, they consistently ranked their recovery experience lowest.

In a prior study,⁹ we developed and piloted an evidence-based, comprehensive ERAS protocol for alloplastic breast reconstruction patients. Key elements of the ERAS protocol were included, including same-day surgery and discharge for eligible patients. The pilot included a prospective comparison of an ERAS patient group to a transitional inpatient group who received some but not all elements of an ERAS protocol. Looking at their quality of recovery (QoR) scores using a validated questionnaire,¹¹ ERAS patients reported significantly less nausea, less severe pain, were better able to enjoy their food and felt more rested than the transitional patients while reporting similar feelings of support and general well-being. A retrospective review of a third group, traditional recovery after surgery (TRAS), was then used to compare length of stay (LOS), complications, emergency department (ED) visits, and readmissions between the groups. We found a decreased LOS (0 nights in hospital ERAS, 1.6 nights in hospital TRAS) with no increase in complications, readmissions, and ED visits in the ERAS group compared to the TRAS group.

With high patient acceptability and initial safety of the protocol demonstrated, we now seek to further establish the safety of this ERAS protocol for alloplastic breast reconstruction patients using a larger sample size. To do so, we retrospectively reviewed all of the patients who underwent alloplastic breast reconstruction with the ERAS protocol to date and compared them to a similarly sized TRAS group.

Methods

A pRoject Ethics Community Consensus Initiative (ARECCI) ethics approval at our institution was sought, underwent second opinion review, and was approved.

Two Groups of Patients

A retrospective chart review was conducted to collect data of patients who underwent alloplastic breast reconstruction (immediate and delayed) by a single reconstructive surgeon working with 3 general surgeons. Two patient groups were compared: those who received TRAS from February 2012 to September 2013 and those who received the full ERAS protocol from September 2013 to March 2016.

Traditional recovery after surgery patients were those who underwent alloplastic breast reconstruction prior to the implementation of the ERAS protocol (September 2013). Patient charts were selected to include the same number as the ERAS group, working back from September 2013. The standard of care at this point in time was overnight admission (patients were counseled to expect overnight stay in hospital), narcotics as the mainstay of analgesia, and no preoperative anti-emetic. Patients were excluded from data analysis if they had medical conditions that would have excluded them from participating in the ERAS protocol (eg, body mass index [BMI] >35 ; American Society of Anesthesiologists [ASA] class >2).

The ERAS patients were all those who qualified for the protocol and underwent alloplastic breast reconstruction after

Table 1. Patient Characteristics.

	ERAS	TRAS	P Value
n	78	78	
Mean age, years	45	49	.02
Bilateral surgery, %	81	55	<.001
Direct to implant, %	66	25	<.001
Immediate reconstruction, %	99	89	.004
Preoperative radiation	6	4	.57
Active smoker ^a , %	3	6	.25

Abbreviations: ERAS, enhanced recovery after surgery; TRAS, traditional recovery after surgery.

^aAny smoking within 30 days of surgery.

September 2013. Inclusion criteria were adequate health status as defined by ASA class 1 or 2 (healthy, or with a well-managed mild systemic disease), and a BMI < 35. Other inclusion criteria were the presence of an adult at home capable and willing to provide basic post-operative care (ie, assisting with medications and ambulation) and living within a 1-hour drive from the hospital. They were booked as day surgery as the first or second case of the day. Additionally, they received standardized perioperative education, including setting the expectation for same-day discharge, multimodal analgesia, and preoperative anti-emetic prophylaxis, and were discharged when they met all standard criteria of the hospital day surgery unit.

Data collection

Patient demographics (including medical conditions, smoking status, and history of radiation), type of surgery, LOS, ED visits, readmissions, and complications within 30 days of surgery were recorded for both groups.

Statistical analysis was conducted using the Microsoft Excel software package (version 14.5.7, 2011; Microsoft for Mac). *t* Test was used for continuous variables, and χ^2 was used for comparison of proportions. A *P* value < .05 was used for significance.

Results

Patient Characteristics

There were 78 patients in both the ERAS and TRAS groups, with 141 breasts operated on in the ERAS group and 121 in the TRAS group. The ERAS patients were younger than those in the TRAS group (45 years, 49 years; *P* = .02). No significant differences were present in the proportion of active smokers (2.6% [2/78] ERAS and 6.4% [5/78] TRAS; *P* = .25) or those who had prior radiation (per breast: 5.7% [8/141] ERAS and 4.1% [5/121] TRAS; *P* = .57) between groups. The ERAS patients underwent significantly more bilateral surgery (80.8% [63/78] ERAS and 55.1% [43/78] TRAS; *P* < .001), immediate reconstruction (per breast: 98.6% [139/141] ERAS and 89.3% [108/121] TRAS; *P* = .004), and had more implants versus expanders placed (per breast: 66% [93/141] ERAS and 24.8% [30/121] TRAS; *P* < .001; Table 1). All

Table 2. Major Complications.

	ERAS	TRAS	P Value
n	78	78	
Mean age, years	45	49	.02
Bilateral surgery, %	81	55	<.001
Direct to implant, %	66	25	<.001
Immediate reconstruction, %	99	89	.004
Preoperative radiation, %	6	4	.57
Active smoker ^a , %	3	6	.25

Abbreviations: ERAS, enhanced recovery after surgery; TRAS, traditional recovery after surgery.

^aAny smoking within 30 days of surgery.

implant/expanders were placed in the sub-pectoral plane. Allo- or auto-dermis was used to complete coverage of the implant in single stage direct-to-implant procedures. All expanders had total muscle coverage.

Length of Stay

The ERAS patients spent significantly less nights in hospital when compared to the TRAS group (0.38 nights ERAS and 1.45 nights TRAS; *P* < .001). The majority of ERAS patients (72% [56/78]) went home the same day of surgery and thus spend 0 nights in hospital. Of the 22 patients who were not discharged on the same day after surgery, 8 were due to administrative booking errors, as they were booked an inpatient bed and sent to the inpatient unit rather than the day surgery area despite being planned for same-day discharge. The remaining 14 were admitted from day surgery due to urinary retention (*n* = 3), nausea (*n* = 3), not feeling ready for discharge (*n* = 3), pain (*n* = 2), post-operative anxiety/need for oxygen (*n* = 1), late case (*n* = 1), and monitoring of breast swelling (*n* = 1).

Emergency Department Visits

There were no differences in the number of ED visits within 30 days of surgery between the 2 groups (8% [6/78] ERAS and 14% [11/78] TRAS; *P* = .2). The 6 ERAS patients presented with gastrointestinal issues (*n* = 2), hematoma (*n* = 1), cellulitis (*n* = 1), seroma (*n* = 1), and partial flap necrosis (*n* = 1). The 11 TRAS patients presented with drain concerns (*n* = 3), cellulitis (*n* = 2), seroma (*n* = 2), partial flap necrosis (*n* = 1), gastrointestinal issues (*n* = 1), post-operative leg numbness (*n* = 1), and anxiety (*n* = 1).

Readmissions

There were no differences in the number of readmissions between the ERAS and TRAS groups (8% [6/78] ERAS and 3.8% [3/78] TRAS; *P* = .3). Of the 6 ERAS patients readmitted, 1 was for a hematoma requiring urgent evacuation (post-operative day [POD] 9), 2 for cellulitis requiring IV antibiotics and explantation (PODs 19 and 24), and the remaining 3 for treatment of cellulitis with IV antibiotics (PODs 18 and 22). Of the 3 TRAS patients readmitted, 1 required IV antibiotics

Table 3. Minor Complications.

	ERAS	TRAS	P Value
n	78	78	
Mean age, years	45	49	.02
Bilateral surgery, %	81	55	<.001
Direct to implant, %	66	25	<.001
Immediate reconstruction, %	99	89	.004
Preoperative radiation, %	6	4	.57
Active smoker ^a , %	3	6	.25

Abbreviations: ERAS, enhanced recovery after surgery; TRAS, traditional recovery after surgery.

^aAny smoking within 30 days of surgery.

and explantation for cellulitis (POD 30), and the remaining 2 required treatment of their cellulitis with IV antibiotics (PODs 15 and 18).

Complications

Due to the increased proportion of bilateral surgery in the ERAS group compared to the TRAS group, complications were assessed per breast (141 ERAS and 121 TRAS). There was no significant difference in the rate of hematoma (0.7% [1/141] ERAS and 0% [0/121] TRAS; $P = .35$), infection requiring IV antibiotics and explantation (1.4% [2/141] ERAS and 0.8% [1/121] TRAS; $P = .65$), infection requiring outpatient IV antibiotics (1.4% [2/141] ERAS and 2.5% [3/121] TRAS; $P = .53$), and infection requiring IV antibiotics and readmission (2.1% [3/141] ERAS and 1.7% [2/121] TRAS; $P = .78$) between the 2 groups (Table 2). Two of the patients with infections requiring IV antibiotics started their IV antibiotics outside of 30 days post-operatively (POD 31 ERAS and POD 34 TRAS) but were included in the complication rate as their infections initially presented within the 30-day mark, were first treated with oral antibiotics, and then progressed to requiring IV antibiotics. There were no differences in the number of patients with minor complications within 30 days of surgery between the 2 groups (22% [31/141] ERAS and 23% [28/121] TRAS; $P = .82$; Table 3). All minor complications were managed in the outpatient setting and none required readmission or operative exploration.

Discussion

The safety of an ERAS protocol for alloplastic breast reconstruction, which includes same-day discharge after surgery, is further confirmed with this study, with no increase in complications, ED visits, or readmission rates between the 2 groups.

Despite the ERAS group having more bilateral and direct-to-implant reconstruction, they spent less time in hospital than the TRAS group, with 71% going home the same day after surgery (0 night stay), compared to 9% in the TRAS group. Reasons for the decreased LOS in the ERAS group are multifactorial and point to an improved recovery in this group compared to the TRAS group. The ERAS patients were counseled in the preoperative setting regarding the anticipated course of

post-operative recovery, and the expectation that they would be fit for same-day discharge was communicated. This preadmission counseling is critical to ensure the success of the day surgery component of the protocol as well as to improve the patients' overall recovery. Past studies emphasized the importance of preoperative counseling and setting expectations for the post-operative course as having a positive effect on all aspects of a patient's recovery after surgery.¹²⁻¹⁵

The use of the preoperative anti-emetic, aprepitant, likely also contributed to the decreased LOS in the ERAS group, as post-operative nausea and vomiting (PONV) is one of the most common causes for prolonged hospital stay.^{12,16} Aprepitant works by blocking neurokinin 1 receptors found in high concentrations in the vomiting center of the brain. By administering it 1 to 2 hours preoperatively, it serves to prevent post-operative nausea and has been shown to be effective in decreasing PONV in patients undergoing breast surgery.¹⁷⁻²⁰ The analgesic cocktail the patients received, including gabapentin, celecoxib, and acetaminophen in addition to the opioid oxycodone, aimed to decrease opioid consumption and improve pain control.^{6,12,21-31} Reducing opioid consumption has been demonstrated to decrease PONV and therefore also contributed to the improved recovery in the ERAS patients.^{16,31,32}

Despite voiced concerns regarding the regular use of non-steroidal anti-inflammatory drugs (NSAIDs) as part of the protocol, there was no difference in the rate of hematoma between the 2 groups, with only 1 hematoma in 141 breasts in the ERAS group. This is less than the 1% hematoma rate described in this patient population.³³ Despite the low incidence, patients are required to live within 1 hour from the hospital to allow for prompt management of this complication, should it arise. We recommend the continued use of NSAIDs as part of the protocol, as their use in combination with other modes of analgesia improves pain control and decreases the need for opioids as well as decreases PONV.^{32,34}

The ability to easily admit patients scheduled for day surgery to hospital overnight was necessary as 18% required admission for pain, PONV, and urinary retention. As all of these cases are performed at a tertiary care center, if the patients did not meet day surgery discharge criteria, the plastic surgery team admitted the patient. It is difficult to predict beforehand which patients will require admission despite meeting criteria for outpatient surgery, and in this group, no particular preoperative characteristics were identified.

Having all members of the care team on board with the ERAS protocol including same-day surgery and discharge is also critical to the protocol's success. This was demonstrated in this patient group, as the 8 patients who would have been eligible to go home were erroneously booked an inpatient bed, and once in the ward, they spent the night. We can speculate that this is due to a difference in expectations of the nurses in the inpatient setting, who were accustomed to having this patient group spend the night, whereas the day surgery nurses were accustomed to discharging post-operative patients on the day of surgery.

The cost savings attributed with the decreased LOS (0.36 nights ERAS and 1.45 nights TRAS) are notable, with each

night spent in hospital at our center costing approximately 2000 Canadian dollars. Additionally, bed shortages are a persistent long-standing issue at the majority of the institutions in Canada,³⁵⁻³⁷ and efforts should be made to implement ERAS protocols that improve patients' recovery to a point where they can safely go home sooner. An initial concern upon the implementation of this ERAS protocol was patient "bounce back" that would negate some of the enhanced recovery and cost savings of the same-day discharge. This did not seem to be an issue in our studied population, as no difference was found in readmission rates or ED visits between the ERAS and TRAS groups.

The reasons for the ED visits in both patient groups point to a need for added post-operative support for these patients. Although the patients are told to contact the surgeon's office to arrange to be seen, should any questions arise, there were still some who presented to the ED with non-urgent issues that could have been simply dealt with in a quicker, less resource intensive way. To ensure that patients continue to feel supported during their immediate post-operative course, additional resources are necessary. A nurse navigator educated on breast cancer and reconstructive surgery would be useful to phone the patients on the first PODs and to be available to answer questions as they arise. As technology becomes ubiquitous in the health-care realm, we should also consider a technological answer to providing post-operative support to patients once they are home. Semple et al³⁷ describe the utility and high patient satisfaction of a smart phone application for monitoring the recovery of patients by photographs and daily completion of QoR questionnaires. This model is also cost-effective for this low-risk ambulatory care patient group.³⁸

The main limitation of this study is its retrospective nature, with the resultant lack of qualitative data in the form of QoR questionnaires available for these groups. The protocol is only applicable for eligible patients, which entails being ASA class 1 or 2, having a support person at home, living within 1 hour from the hospital, and having a BMI < 35; however, these criteria are mainly to denote the patients who are candidates for the same-day discharge. The remainder of the protocol, including preoperative education, limited preoperative fasting, prophylactic anti-emetic, and multimodal analgesia, should be used for all patients without contraindications, as these measures have been shown to improve the recovery experience.

Conclusions

An ERAS protocol for alloplastic breast reconstruction is safe, allowing decreased LOS, without increased complications, readmission rates, or ED visits compared to TRAS.

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Declaration of Conflicting Interests

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