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HOT TOPIC

Enhanced Recovery After Surgery (ERAS): Protocols in Post-Mastectomy Breast Reconstruction

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Abstract

Purpose of Review Enhanced recovery after surgery (ERAS) protocols have become common for patients undergoing breast reconstruction, catalyzed by the recent opioid crisis. Here, we review standard ERAS protocol structure and the supporting evidence.

Recent Findings A perioperative multidisciplinary team and multimodal pain management appropriately are the two critical factors for ERAS success. Preoperative counseling, both antibiotic and venous thromboembolic prophylaxis, and multimodal antiemetics are crucial to optimize results. Regional nerve blocks provide an alternative to oral and intravenous opioids. Intraoperative minimization of inhaled anesthetics and complete IV analgesia is recommended along with team communication. A postoperative opioid-sparing approach with medications such as acetaminophen, NSAIDs, and gabapentin is needed along with an early diet, patient mobilization, and IV fluid and Foley catheter discontinuation.

Summary ERAS protocols for breast reconstruction have shown a decrease in length of stay, intraoperative and postoperative narcotic use, and perioperative costs while simultaneously increasing patient satisfaction.

Keywords Breast cancer · Reconstruction · Mastectomy · ERAS · Enhanced recovery after surgery

Introduction

Over the past two decades, the opioid epidemic in the United States (US) has become a highly discussed topic among medical professionals, the media, and the general public. In 2018 alone, over 46,000 individuals died from opioid overdose in the US, with 32% directly linked to prescription opioids [1]. In an effort to simultaneously reduce opioid prescriptions while maximizing postoperative recovery, surgeons began developing and implementing enhanced recovery after surgery (ERAS) protocols [2].

The term "ERAS" was first introduced in the early twenty-first century [3]. Prior to 2001, several publications had used the term "fast-track" surgery that described a similar approach to current ERAS protocols [4, 5]. Both terms describe evidence-based protocols that utilize a multidisciplinary team for a multimodal pain management approach with patient engagement and ongoing protocol evaluation and evolution with the ultimate goal of optimizing quality of care [6].

In 2011, the first ERAS protocol for breast reconstruction was published and since then, multiple series have been published and provide the evidence for current protocols (Fig. 1) [7]. With over 101,000 breast reconstruction cases in 2018, there is an exceptionally large patient population who can benefit from ERAS protocol implementation [8]. The protocols for breast reconstruction have shown a decrease in length of stay (LOS), decrease in intraoperative and postoperative narcotic use, and an overall decrease in perioperative costs, with a simultaneous increase in patient satisfaction [7, 9•, 10••]. Here we review the current evidence for perioperative ERAS protocol management for patients undergoing breast reconstruction after mastectomy.

Preoperative Protocols

Days Prior to Surgery

The preoperative phase of ERAS begins in the clinic with extensive preoperative counseling to set realistic expectations

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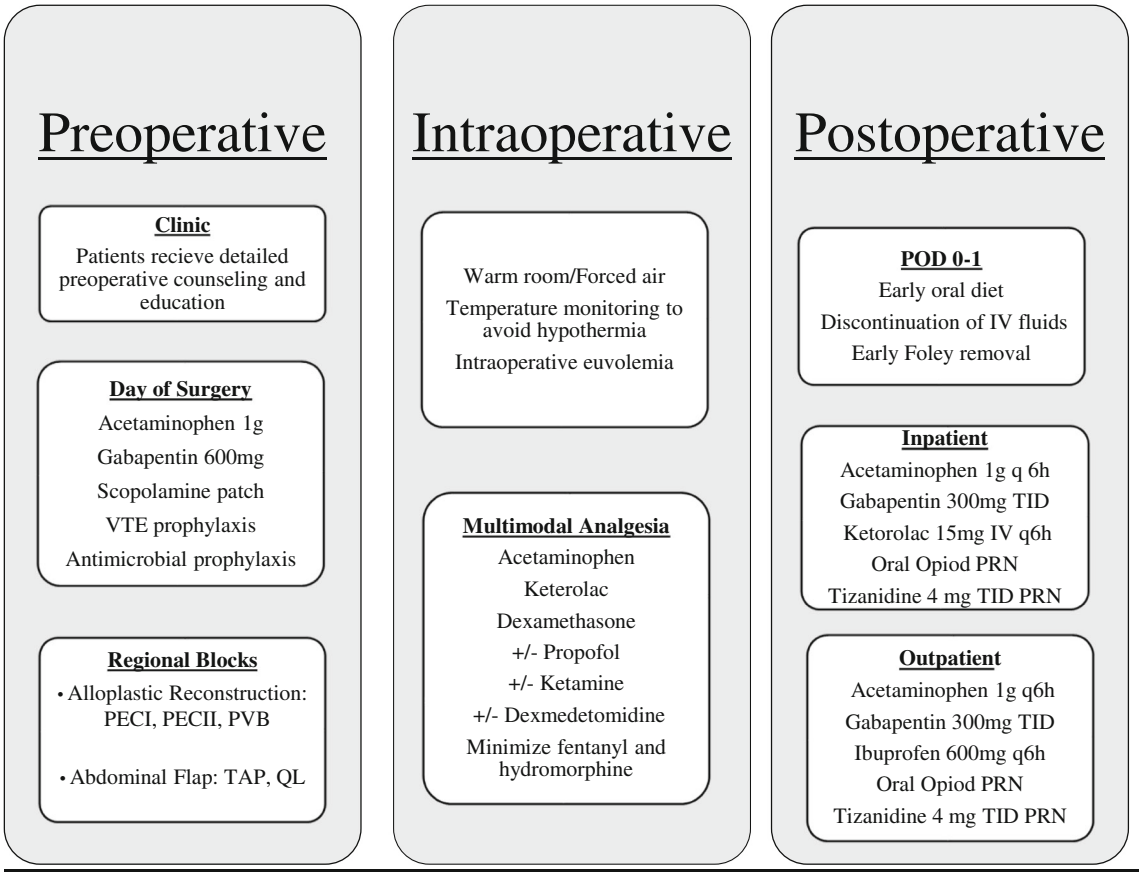

Fig. 1 Example of the perioperative ERAS protocol for breast reconstruction at our institution

for both the perioperative and postoperative period. Preoperative education leads to earlier achievement of postoperative milestones for discharge, reduction in patient anxiety, and improvements in patient satisfaction [11•, 12]. Additionally, preoperative medical optimization such as smoking and alcohol cessation for at least 4 weeks prior to surgery, weight loss, and tight glucose control for diabetic patients can all help minimize postoperative complications [11•, 12]..

Day of Surgery

Pain Management

Opioid-sparing pain management plans are initiated preoperatively using a combination of both oral medications and regional anesthesia [11•, 13, 14•, 15••, 16•]. Oral medications include acetaminophen, gabapentin, and celecoxib [11•, 17•]. Acetaminophen is utilized in all three phases of the ERAS protocol and its use is well established across all surgical specialties as an effective drug for both pain control and reduction of opioid use in the perioperative period [11•]. Preoperative use of gabapentin has been shown to significantly decrease postoperative pain, postoperative opioid use, and postoperative nausea and vomiting (PONV) [11•, 13, 14•, 18–22] The available regional anesthesia techniques for breast reconstruction have all led to significant reductions in postoperative pain, opioid use, and PONV along with an associated decreased LOS [11•, 22, 23••, 24]. The reduction in PONV is likely secondary to both lower opioid and inhaled gas requirements during general anesthesia [23••, 24, 25]..

There are several regional anesthesia techniques that can be utilized based on the planned approach for breast reconstruction (Table 1). For alloplastic (implant)-based reconstruction, paravertebral (PVB), pectoral nerve (which includes PEC I and PEC II), serratus anterior plane (SAP), and erector spinae plane (ESP) blocks can be used [12, 23••, 24, 25, 26]. Additional regional anesthesia options for patients undergoing abdominal-based autologous reconstruction include blocks to the transversus abdominis plane (TAP), quadratus lumborum block (QLB), and ESP planes [27–30]. All blocks, except the PVB, are considered intrafascial plane blocks because they rely on anesthetic spread throughout their respective fascial compartment to reach the targeted nerve(s) [28–30]. Intrafascial plane blocks are more superficial injections with a lower risk for the serious complications that can occur with a PVB including vascular perforation, pneumothorax, and hypotension [19, 24, 25, 29]. Lastly, an injection of liposomal

Table 1 Description of the regional anesthesia blocks for breast reconstruction

Type of block	Description
Chest wall blocks	
Paravertebral (PVB)	LA injection into the paraspinal space providing both somatic and sympathetic nerve blocks to the dermatomes above and below the injection site [18, 22, 23••, 24]
Pectoral nerve—PEC I	LA injection near medial and lateral pectoralis nerves targeting the anterior chest wall [18, 22, 23••]
Pectoral nerve—PEC II	PEC I plus LA injection near the intercostobrachial and intercostal nerves targeting the anterior and lateral chest wall [22]
Serratus anterior plane (SAP)	LA injection in the SAP targeting the thoracic intercostal nerves for lateral chest wall coverage (similar to a PEC II) [22, 25]
Abdominal wall blocks	
Transversus abdominis plane (TAP)	LA injection in the TAP targeting the T6-L1 sensory nerves for anterior abdominal wall coverage [26]
Quadratus lumborum (QLB)	LA injection near the QL muscle targeting the thoracolumbar fascia along the T7-L1 for posterior abdominal wall and abdominal viscera coverage [11•, 24, 27]
Abdominal and chest wall blocks	
Erector spinae plane (ESP)	LA injection deep in the ES muscle which spreads into the paravertebral space targeting either the chest or abdominal wall depending on the level of injection [28, 29]

LA local anesthesia

bupivacaine is an option for an increased duration of analgesia obtained from either a preoperative block or can be directly injected into the surgical wound intraoperatively [31].

Antiemetics

Multimodal antiemetics targeting different receptors have been shown to significantly reduce the incidence of PONV [15••, 19]. In the preoperative phase, scopolamine patches, ondansetron, and gabapentin can be utilized to minimize PONV [17, 32•].

Venous Thromboembolism

Venous thromboembolism (VTE) rates in patients undergoing breast reconstruction are double that of patients undergoing lumpectomy or mastectomy alone [15••, 33]. Preoperative mechanical prophylaxis with sequential compression devices should be used and pharmacological VTE prophylaxis should be considered for all reconstruction cases [15••].

Intraoperative Protocols

Cleaning and Antibiotic Prophylaxis

Infectious complications are known to be higher in breast reconstruction surgery when compared with other breast surgeries [15••]. Skin preparation with aqueous-based chlorhexidine gluconate (CHG) solution with a minimum of 3-min dry time is preferred [34, 35]. In line with national surgery guidelines including the Surgical Care Improvement Project (SCIP), intravenous antibiotics targeting common skin bacterial flora should be infused within 1 h of the skin incision [15••, 36]. There is currently no evidence supporting continued antibiotic use beyond 24 h after breast reconstruction surgery, regardless of surgical drain status [15••, 37].

Temperature Management

Maintaining the patient at a euthermic core temperature of 36 °C or higher has been shown to reduce a multitude of complications including infection and wound healing [38, 39]. Forced-air measures are needed for appropriate patient warming and include forced-air warming blankets, which are the most effective, along with underbody warming and circulating water garments [38, 40]. Warmed intravenous fluids and humified air should be considered by the anesthesia team, while the surgical team should consider warm fluid for surgical irrigation [41].

Intravenous Fluid Management

Aggressively maintaining euvolemia is critical to prevent adverse events. An inability to maintain euvolemia has been shown to result in increased risks for cardiopulmonary events,

wound infection, and healing and has been shown to be prothrombic in tissue-based reconstruction [42, 43]. Warm fluids with balanced crystalloids should be used whenever possible to maintain appropriate electrolyte balance. The administration of vasopressor support in euvolemic patients has been shown to be safe and effective [44•]. Foley catheters should be considered for operations lasting longer than 3 h and should be removed promptly at the completion of the operation or as soon as possible prior to hospital discharge [17•].

Analgesia and Anesthetic Management

Multimodal intraoperative analgesia and anesthetic management are crucial to postoperative outcomes in ERAS patients. Communication between the surgical and anesthesia teams is imperative and reviewing analgesia management should be considered as part of the standard time-out [17•].

Nitrous oxide and inhalation agents should be avoided, and total intravenous analgesia management should be employed when possible. For sedation, a propofol infusion should be used in the absence of any contraindications. Ketamine and dexmedetomidine may also be used; however, both can cause hypotension and bradycardia [17•, 32•]. To minimize PONV, dexamethasone may be given after induction and a dose of ondansetron should be given prior the end of the case. Promethazine can also be added if needed [17•, 32•].

Multimodal pain control is achieved by using several medications. Intravenous or oral acetaminophen is given preoperatively every 6 h thereafter. Ketorolac and other NSAIDs can be used with no increase in risks for postoperative bleeding complications [45–49]. As-needed intravenous pushes of fentanyl and/or hydromorphone are given for breakthrough pain [17•]. At the completion of the operation, the surgically placed wound catheters for postoperative anesthetic infusion may also be considered; however, the current evidence does not strongly support their use [50, 51].

Postoperative Protocols

Pain Management

Optimal perioperative pain management requires an opioid-sparing multimodal pain protocol to reduce total opioid consumption [15••, 52•, 53•, 54•, 55]. This includes an inpatient and outpatient pain management regimen that is weaned over the course of 1–2 weeks and includes scheduled acetaminophen, NSAIDs, gabapentin, as-needed opioids, and rarely muscle relaxants [15••]. The combination of acetaminophen and NSAIDs is more effective than either alone in managing postoperative pain [56]. Intravenous acetaminophen is more costly while not necessarily more effective compared with oral administration [57].

Diet and PONV

Patients are advanced to a regular diet as soon as possible with early discontinuation of intravenous fluids to minimize the risk of complications [42, 43]. Early advancement to a regular diet and reduction in PONV all serve to improve patient satisfaction after surgery. Early refeeding within 24 h after surgery is safe and associated with improved healing, reduced infection rates, and reduced hospital LOS [58].

Mobilization and Length of Stay

Barriers to discharge for breast reconstruction are most often mobilization and pain control. Early mobilization has been shown to increase muscle strength, improve pulmonary function, and decrease venous thromboembolism [59, 60]. ERAS postoperative protocols improve early mobilization and decrease hospital LOS [61••]. Recent analyses have found a significant reduction in LOS for ERAS patients to be on average 1.0–1.35 days shorter compared with standard protocols without an increased rate of postoperative complications or hospital readmission rates [32•, 52•, 53•]..

For implant-based reconstruction, patients using an ERAS protocol are more likely to be discharged the same day (58.6%) compared with the standard (7.2%) without an increased risk of complications [62]. Patients undergoing microvascular autologous breast reconstruction in an ERAS protocol have been shown to be discharged an average of 2 days earlier compared with the standard average of 5–6 days [55].

Conclusion

ERAS protocols involve a multidisciplinary and multimodal approach to perioperative care. Key elements include preoperative counseling and education, multimodal pain management using regional blocks and opioid-sparing techniques, VTE and PONV prophylaxis, and early mobilization. Complete protocol implementation requires close collaboration between anesthesia providers, the surgical team, and patients. ERAS protocols for breast reconstruction are both safe and effective and allow for a decreased LOS, decreased narcotic usage, and an economic benefit by decreasing hospital costs. Future research should address long-term outcomes and patient-reported satisfaction using validated procedure-specific surveys. This data can be used to further expand and improve upon the current ERAS protocol recommendations to optimize patient safety, quality, and satisfaction.

Compliance with Ethical Standards

Conflict of Interest Chandler Cortina, Caitlin Patten, Karri Adamson, and Erin Doren declare no conflicts of interest relevant to this manuscript.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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