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Breast

Enhanced Recovery after Surgery Protocol Decreases Length of Stay and Postoperative Narcotic Use in Tissue Expander-based Breast Reconstruction

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Background: Enhanced recovery after surgery (ERAS) protocols have demonstrated success in reducing hospital stay and opioid consumption, but are less well studied in patients undergoing tissue expander-based breast reconstruction (TEBR). This study evaluates the effectiveness of an ERAS postoperative protocol for TEBR at a high-volume center.

Methods: All patients undergoing immediate tissue expander reconstruction after the introduction of ERAS were prospectively included from April 2019 to June 2023. An equivalent number of similar patients were retrospectively reviewed before this date as the non-ERAS control. Data included demographics, operative details, postoperative length of stay, inpatient and discharge narcotic quantities, inpatient pain assessments, postoperative radiation, and complications within 90 days.

Results: There were 201 patients in each cohort with statistically similar demographics. Patients in the ERAS cohort were more likely to undergo prepectoral reconstruction (83.1% versus 4.5%, $P < 0.001$), be discharged by day 1 (96.5% versus 70.2%, $P < 0.001$) and consume lower inpatient milligram morphine equivalent (MME) median (79.8 versus 151.8, $P < 0.001$). Seroma rates (17.4% versus 3.5%, $P < 0.001$) and hematoma incidence (4.5% versus 0%, $P = 0.004$) were higher in the ERAS cohort. Adjusting for implant location, ERAS was associated with a 60.7 MME reduction (β=-60.7, $P < 0.001$) and a shorter inpatient duration by 0.4 days (β =-0.4, $P < 0.001$). Additionally, prepectoral reconstruction significantly decreased MME (β=-30.9, $P = 0.015$) and was the sole predictor of seroma development (odds ratio = 5.2, $P = 0.009$).

Conclusions: ERAS protocols significantly reduce opioid use and hospital stay after TEBR.
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INTRODUCTION

Enhanced recovery after surgery (ERAS) represents a multi-faceted approach to surgical care, aimed at improving patient outcomes.[1,2] Within plastic and reconstructive surgery (PRS), ERAS protocols have reliably demonstrated success reducing postoperative length of stay (LOS) and minimizing inpatient narcotic use without increasing morbidity.[3–11] One critical component of the ERAS protocol is preoperative patient counseling, a fundamental yet frequently underestimated aspect of ERAS. This step is instrumental in establishing patient expectations regarding early discharge, decreasing postoperative narcotic use, and improving patient awareness of postoperative complications that necessitate medical attention.[12,13] Furthermore, the ERAS protocol incorporates the use of multimodal analgesics, targeting several receptor sites to limit narcotic usage and mitigate medicinal side effects during all perioperative phases.[14] Although each of these elements contributes independently to favorable surgical outcomes, their synergistic effects are responsible for the dramatic improvements that are reproducibly observed

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with implementation of ERAS protocols for various surgical procedures.[15–18]

Despite the supportive evidence for ERAS protocols in general, their adoption has been limited in tissue expander-based breast reconstruction (TEBR). This reluctance may stem from existing literature's constraints, characterized by small cohorts, heterogeneous demographics, and the absence of clear control groups.[19–22] Our study addresses this gap by comparing the ERAS pathway with traditional protocols in TEBR, using sizeable, demographically similar cohorts. Additionally, we sought to determine the effects of ERAS separate from the influence of expander placement techniques. This component is crucial, as prepectoral placement, which avoids submuscular dissection, typically results in less pain and reduced narcotic use—outcomes also attributed to ERAS.[23–27] This nuanced analysis may subsequently refine our understanding of ERAS's role in TEBR, potentially shaping future protocols to improve patient recovery and safety postmastectomy.

Our investigation aimed to compare postoperative outcomes of ERAS and non-ERAS patients who underwent TEBR following mastectomy at our institution. We hypothesized that the ERAS cohort would exhibit reduced narcotic consumption, shorter LOS, and comparable postoperative complication rates relative to non-ERAS controls.

METHODS

Institutional review board approval was obtained through the University of California–Los Angeles (approval no. 23-000595).

Study Design and Participants

Our study investigated patients who underwent bilateral or unilateral TEBR postmastectomy at our academic institution. Exclusion criteria were patients undergoing direct-to-implant reconstruction, any form of microvascular breast reconstruction, delayed TEBR and those who had undergone differing bilateral procedures, such as having a TEBR on one breast while undergoing microvascular reconstruction on the other.

All eligible patients treated between April 4, 2019, and June 6, 2023, following the implementation of the ERAS protocol, were classified as the ERAS group. Conversely, the non-ERAS control cohort consisted of an equivalent number of patients who underwent surgery before April 4, 2019 in reverse chronological order. The ERAS group's data were collected prospectively, whereas the non-ERAS control patient data were collected retrospectively. For both cohorts, extracted data included age, body mass index (BMI), surgical laterality, positioning of the tissue expander relative to the pectoralis major, use of acellular dermal matrix (ADM), surgical duration, postoperative LOS, inpatient narcotic utilization, prescribed narcotics upon discharge, inpatient pain scores, presence of postoperative radiation therapy, and any complications (within the 90-day postoperative period).

Takeaways

Question: What are the effects of enhanced recovery after surgery (ERAS) protocols on length of hospital stay and opioid use in patients undergoing tissue expander-based breast reconstruction?

Findings: ERAS protocols led to reduced hospitalization and opioid use, with an acceptable rate of complications. ERAS and prepectoral implant placement significantly decreased narcotic consumption, with ERAS alone reducing inpatient opioid use by 60.7 milligram morphine equivalents and shortening hospital stay.

Meaning: ERAS protocols significantly shorten hospital stays and reduce opioid use after tissue expander-based breast reconstruction, enhancing patient recovery while maintaining an acceptable complication rate.

ERAS Protocol and Key Changes

The ERAS protocol used a structured perioperative care strategy, starting with preoperative counseling led by attending surgeons. Key objectives of this phase included clarifying the protocol's aims, describing strategies for narcotic reduction, establishing expectations for discharge, and educating patients on postoperative symptoms that warrant medical attention. Additionally, ERAS patients received a regimen of preoperative nonopioid analgesics on the morning of surgery. In contrast, the traditional cohort did not receive preoperative counseling or pain medication.

Intraoperatively, patients in the ERAS cohort were administered pectoralis blocks targeting the brachial plexus and thoracic intercostal nerves (PECS I/II block) with 0.25% Marcaine and epinephrine, followed by an intravenous injection of 15 mg Toradol at the point of surgical closure or upon arrival in the postanesthesia care unit (PACU). This standardized pain management protocol contrasts with the practice for the non-ERAS cohort, wherein intraoperative analgesia was subject to the anesthesia team's discretion.

In the postoperative phase, the ERAS protocol implemented a comprehensive multimodal analgesic strategy. This included a regimen of oxycodone, acetaminophen, celecoxib, and gabapentin, supplemented with hydromorphone as needed for breakthrough pain. This approach represents a deviation from the non-ERAS protocol, which primarily relied on oxycodone and a lower dosage of acetaminophen. The non-ERAS protocol also used hydromorphone as needed for breakthrough pain.

Upon discharge, the ERAS protocol used a multimodal analgesic strategy with a deliberate reduction in prescribed narcotics. Patients were prescribed a combination of oxycodone, ibuprofen, gabapentin, and acetaminophen. Conversely, the traditional discharge protocol was characterized by increased quantities of oxycodone, and decreased dosages of acetaminophen, Table 1.

Outcomes

Milligram Morphine Equivalent Calculation

Both in-hospital narcotic use and outpatient narcotic prescriptions were quantified as milligram morphine

Table 1. Traditional vs ERAS Pathway Protocols

Traditional Pathway	ERAS Pathway
Preoperative	**Preoperative (Day of Surgery)**
None	Acetaminophen 1000 mg PO, celecoxib 400 mg PO, gabapentin 300 mg PO, ondansetron 4 mg IV
Intraoperative	**Intraoperative**
Discretion of anesthesia team	Intraoperative PECS I/II block with 0.25% Marcaine with epinephrine
No nerve block	Toradol 15 mg IV (upon closing or in PACU)
POD 0	**POD 0**
Sliding scale oxycodone [5/10/15mg, dependent on mild (0–3)/moderate (4–6)/severe (7–10) pain], hydromorphone 0.4 mg PRN breakthrough pain, acetaminophen 650 mg q6h, ondansetron	Sliding scale oxycodone [5/10/15 mg, dependent on mild (0–3)/moderate (4–6)/severe (7–10) pain], acetaminophen 1000 mg q8h PO, celecoxib 200 mg PO q12h, gabapentin 300 mg PO q8h, Hydromorphone 0.4 mg PRN breakthrough pain, ondansetron/metoclopramide
Customary diet	Customary diet
POD 1	**POD 1**
Continue pain regimen above, occupational therapy consult for activities of daily living, nurse practitioner drain teaching, discharge following morning rounds	Continue pain regimen above, occupational therapy consult for activities of daily living, nurse practitioner drain teaching, discharge following morning rounds
Discharge medications: oxycodone 5 mg q4h PRN (30–120 Tablets), acetaminophen 650 mg q6h, Colace, Senna, Miralax	Discharge medications**:** acetaminophen 1000 mg q8h, ibuprofen 400 mg q6h, gabapentin 300 mg q8h, oxycodone 5 mg (20 tablets) prn, Colace, Senna, Miralax

IV, intravenous; PO, per os; POD, postoperative day; PRN, pro re nata.

equivalents (MMEs). Initially, each narcotic was translated into its respective oral equivalent dosage. The resultant value was multiplied by the dosage quantity, and then converted to MME. We used the conversion coefficients outlined in the CONSORT classification for each medication (Table 2).[28] The cumulative MME for each patient was then calculated by adding the MMEs for all medications taken during their postsurgical in-hospital stay. A separate but identical calculation was performed for total outpatient narcotic prescriptions, including any refills. Quantifying total amount consumed would have been unreliable in the retrospective cohort because it would have depended on patient recall from several years prior.

Pain Score Calculation

For both cohorts, postoperative pain scores were calculated. Using a visual analog scale, our nursing team prompted patients to quantify their pain intensity, with a scale ranging from 0 (absence of pain) to 10 (most severe pain conceivable). These assessments were routinely performed preceding each scheduled pain medication dose. The acquired scores were documented in the individual patient's medical record. However, daily survey frequencies fluctuated due to patient-related variables, such as sleep patterns and engagement willingness. For analysis, we computed the mean pain score for every postoperative day (POD) for each patient. Subsequently, we compared these average scores on each POD between the cohorts.

Table 2. MME Conversion Factors

Medication	Conversion Factor
Codeine	0.150
Fentanyl (transmucosal)	0.125
Hydrocodone	1.000
Hydromorphone	4.000
Morphine	1.000
Oxycodone	1.500
Tramadol	0.100

For example, for patients who received eight 5-mg PO oxycodone doses during their inpatient stay: (8×5) × 1.5 = 60 MME.

Statistical Analysis

Statistical analyses to compare the ERAS and traditional cohorts used chi-square or Fisher exact and *t* tests or Wilcoxon rank-sum tests, as appropriate. During the study period, our institution experienced an alteration in tissue expander placement preferences. Subpectoral placement, the norm until 2018, has been associated with increased postoperative pain, increased narcotic use, and lower seroma rates compared with prepectoral placement.[23–26,29] To account for this potential confounding, multivariable linear and logistic regression models were constructed to evaluate the independent effects of the ERAS protocol on inpatient MME, inpatient LOS, and postoperative complications, while controlling for expander placement. The linear models' integrity was verified by confirming linearity, homoscedasticity, independence of residuals (Durbin-Watson statistic), absence of collinearity (variance inflation factors <2), and residual normality (P-P plots). Furthermore, the fit of logistic regression models was assessed using the Hosmer–Lemeshow test, which yielded *P* values greater than 0.05 for each dependent variable, indicating an adequate model fit. Significance was set at a *P* value less than 0.05, with analyses conducted using SPSS 28.0 (SPSS Inc., Chicago, Ill.).

RESULTS

A comparative analysis was performed on 402 patients undergoing TEBR, divided into two cohorts of 201 individuals each. The median age was 49.2 years in the traditional cohort and 47.5 years in the ERAS cohort, with

no significant age difference between the groups (P = 0.779). Operative durations were comparable (ERAS: 194.0 minutes versus Non-ERAS: 187.0, P = 0.380), and were reported as the cohort median. Bilateral reconstruction rates were also similar, with 77.1% in the traditional and 76.1% in the ERAS cohort (P = 0.814). The use of ADM was consistent across both cohorts, with comparable percentages (ERAS: 98.0% versus Non-ERAS: 99.5%, P = 0.372). The BMI distribution was evenly matched between cohorts, with a proportionate number of patients across the underweight, normal, overweight, and obese categories (P = 0.061). Radiation therapy rates during tissue expander presence were similar across cohorts (ERAS: 16.9% versus non-ERAS: 18.9%; P = 0.603). Our institutional practice shifted over time regarding the placement of tissue expanders; before 2018, subpectoral placement was standard. As a result, the ERAS cohort had a notably higher incidence of prepectoral placement (83.1% versus 4.5%; P < 0.001; Table 3).

Consistent with the increased prepectoral expander placement rate, we found the ERAS group to also have a significantly increased rate of postoperative seroma (17.4% versus 3.5%; P < 0.001). Furthermore, the ERAS cohort exhibited a significantly higher incidence of postoperative hematomas (4.5% versus 0%; P = 0.004). In contrast, the rates of postoperative cellulitis/infection did not differ between the groups (ERAS 4.5%, traditional 6.0%; P = 0.501). Similarly, the incidence of skin necrosis/eschar/ischemia necessitating reoperation was comparable between the two groups (ERAS 2.0%, traditional 3.5%; P = 0.359).

The median inpatient total MME was less in the ERAS group when compared with the traditional cohort (79.8 versus 151.8; P < 0.001). When restricting to only POD 0-1, we saw a similar trend (ERAS: 78.6 MME versus 141.9 MME; P < 0.001). In addition to the reduction in MME, the ERAS cohort reported significantly lower pain levels on POD 0 (2.8 versus 3.6; P < 0.001) and POD1 (2.9 versus 3.4; P = 0.008). Furthermore, the ERAS cohort had a significantly shorter LOS, with 96.5% of the ERAS cohort patients being discharged by the end of postoperative day 1, in contrast to 70.2% in the traditional cohort (P < 0.001). At discharge, the ERAS group was prescribed a median of 225.0 less MME, a statistically significant difference (150.0 versus 375.0; P = 0.003; Table 4).

ERAS as an Independent Predictor of Improved Outcomes

To identify independent predictors of postoperative outcomes, multivariable models were developed. These models considered factors such as prepectoral implant placement and presence of the ERAS protocol. These factors were chosen as both have been previously reported to affect several of the measured outcomes.[23–27,29] Multivariable linear regression models were developed for continuous outcomes, whereas multivariable logistic regression models were used for categorical outcomes. The results from these models are shown below:

MME Totals

In the analysis, presence of the ERAS protocol and presence of prepectoral implants were both significant predictors of decreased narcotic consumption during the inpatient postoperative period. Notably, the presence of

Table 3. Traditional versus ERAS Patient and Surgical Demographics

		Cohort		
	Total (N = 402)	**Traditional (N = 201)**	**ERAS (N = 201)**	***P***
Age, median (IQR)	48.4 (41.7, 58.8)	49.2 (42.3, 58.6)	47.5 (41.1, 59.7)	0.779*
BMI, n (%)				0.061*
Underweight	17 (4.2%)	9 (4.5%)	8 (4.0%)	
Normal	244 (60.7%)	126 (62.7%)	118 (58.7%)	
Overweight	98 (24.4%)	46 (22.9%)	52 (25.9%)	
Obese	43 (10.7%)	20 (9.9%)	23 (11.4%)	
Laterality, n (%)				0.814†
Bilateral	308 (76.6%)	155 (77.1%)	153 (76.1%)	
Unilateral	94 (23.4%)	46 (22.9%)	48 (23.9%)	
Operative time (min), median (IQR)	189.5 (156.0–225.0)	187.0 (162.5–229.5)	194.0 (148.5–219.5)	0.380*
Implant placement, n (%)				<0.001†
Prepectoral	176 (43.8%)	9 (4.5%)	167 (83.1%)	
Subpectoral	226 (56.2%)	192 (95.5%)	34 (16.9%)	
ADM use, n (%)				0.372‡
Present	397 (98.8%)	200 (99.5%)	197 (98.0%)	
Not present	5 (1.2%)	1 (0.5%)	4 (2.0%)	
Radiation therapy, n (%)				0.603†
Present	72 (17.9%)	38 (18.9%)	34 (16.9%)	
Not Present	330 (82.1%)	163 (81.1%)	167 (83.1%)	

*Wilcoxon rank-sum P value.
†Chi-square P value.
‡Fisher exact P value.

Table 4. Traditional versus ERAS Postoperative Outcomes

		Cohort		
	Total (N = 402)	Traditional (N = 201)	ERAS (N = 201)	*P*
Complications, n (%)				
Seroma	42 (10.4%)	7 (3.5%)	35 (17.4%)	<0.001*
Cellulitis/infection	21 (5.2%)	12 (6.0%)	9 (4.5%)	0.501*
Hematoma	9 (2.2%)	0 (0.0%)	9 (4.5%)	0.004†
Skin necrosis/eschar/ischemia	11 (0.7%)	7 (3.5%)	4 (2.0%)	0.359†
Morphine equivalents (MME), median (IQR)				
Total inpatient period	111.8 (67.1 to 163.5)	151.8 (104.4 to 227.9)	79.8 (51.8 to 113.9)	<0.001‡
POD 0–1	111.3 (66.9 to 156.1)	141.9 (99.8 to 200.0)	78.6 (51.8 to 113.4)	<0.001‡
Discharge prescriptions	150.0 (150.0 to 375.0)	375.0 (225.0 to 450.0)	150.0 (150.0 to 150.0)	<0.001‡
Pain (POD), mean (SD)				
0	3.2 (2.1)	3.6 (2.1)	2.8 (2.0)	<0.001§
1	3.3 (2.0)	3.4 (2.0)	2.9 (1.9)	0.008§
Length of stay (d), n (%)				<0.001‡
0	26 (6.5%)	1 (0.5%)	25 (12.4%)	
1	309 (76.9%)	140 (69.7%)	169 (84.1%)	
2	57 (14.1%)	50 (24.9%)	7 (3.5%)	
3	10 (2.5%)	10 (5.0%)	0 (0.0%)	

*Chi-square *P* value.
†Fisher exact *P* value.
‡Wilcoxon rank-sum *P* value.
§Equal variance two sample *t* test.

ERAS accounted for a 60.7 MME reduction (β = −60.7; $P < 0.001$), whereas prepectoral implant placement accounted for a 30.9 MME reduction (β = −30.9; $P = 0.015$) during the entire postoperative inpatient period.

Length of Stay

The multivariable linear regression model found that ERAS protocol presence was the sole significant predictor of decreased LOS (β = −0.4; $P < 0.001$).

Postoperative Patient Reported Pain

The model also assessed POD 0 and POD 1 pain scores, respectively. At both timepoints, prepectoral placement was found to be the only predictor of decreased pain (POD 0: β = −1.4, $P < 0.001$; POD 1: β=-0.7, $P = 0.035$; Table 5).

Seroma

The logistic regression model identified prepectoral implant placement as the sole significant predictor of increased seroma occurrence. Those with prepectoral implants were 5.2 times more likely to develop a seroma [odds ratio = 5.20, $P = 0.009$, 95% confidence interval (CI) = 1.51, 17.96].

Neither predictor was found to be statistically significant for the remaining postoperative outcomes, including cellulitis/infection, hematoma, and skin necrosis/eschar/ischemia (Table 6).

DISCUSSION

ERAS protocols are well established in various PRS procedures, as they enhance perioperative outcomes via recovery optimization and multimodal analgesia.[3–11] However, they have yet to become the standard for perioperative care in patients undergoing TEBR after mastectomy. This may be attributed to the current literature's constraints, which include studies with limited sample sizes, inconsistent patient demographics, or the absence of an appropriate control group.[19–22] Our comparative analysis sought to mitigate these issues by presenting data from a sizeable, demographically similar cohort and isolating the impact of ERAS protocols from potential confounding variables. As a result, these findings may enhance the credibility and applicability of ERAS protocols within the context of post-mastectomy TEBR.

ERAS has been pivotal in reducing postoperative LOS for a multitude of procedures.[3–11] Our data reinforce this finding, showing a notable decrease in LOS for patients in the ERAS group even after accounting for prepectoral placement in a multivariable model. As the practice of same-day discharge post-TEBR gains momentum,[30,31] these results may provide empirical evidence for ERAS being a cornerstone of safe outpatient TEBR. Specifically, we saw an approximately 25-fold increase in our same-day discharge rate following ERAS implementation. This has substantial economic benefits as the average billed amount for an overnight postsurgery stay at major academic centers is approximately $62,500, inclusive of hoteling, nursing, medication, and ancillary care. This figure drops to $18,000 for same-day procedures, equating to savings of $44,500 per case.[32–36] Beyond direct cost reduction, ERAS contributes to the conservation of hospital resources by enabling care teams to achieve earlier discharge goals more consistently. This practice has particular relevance in the context of the recent COVID-19 pandemic, which forced many previously inpatient procedures into ambulatory centers. Furthermore, earlier discharge mitigates

Table 5. Multivariable Linear Regression Models for Postoperative Outcomes

	MME Totals, Adjusted R^2 = 0.242			LOS, Adjusted R^2 = 0.158			Pain: Postoperative Day 0, Adjusted R^2 = 0.078			Pain: Postoperative Day 1 Adjusted R^2 = 0.025		
Variables	**β**	**95% CI**	***P***	**β**	**95% CI**	***P***	**β**	**95% CI**	***P***	**β**	**95% CI**	***P***
Prepectoral TEBR	−30.85	−55.63 to −6.07	0.015	−0.03	−0.19to 0.13	0.706	−1.41	−2.07 to −0.74	<0.001	−0.72	−1.39 to −0.05	0.035
ERAS presence	−60.67	−85.26 to −36.08	<0.001	−0.41	−0.57 to −0.25	<0.001	0.25	−0.41 to 0.91	0.450	0.02	−0.64 to 0.68	0.962

Table 6. Multivariable Logistic Regression Models for Postoperative Outcomes

	Seroma			Cellulitis/Infection			Hematoma			Skin Necrosis/Eschar/Ischemia		
Variables	**Odds Ratio**	**95% CI**	***P***	**Odds Ratio**	**95% CI**	***P***	**Odds Ratio**	**95% CI**	***P***	**Odds Ratio**	**95% CI**	***P***
Prepectoral TEBR	5.20	1.51 to 17.96	0.009	1.84	0.38 to 8.86	0.445	1.21	0.26 to 14.81	0.835	4.76	0.68 to 33.11	0.115
ERAS presence	1.19	0.34, 4.16	0.781	0.45	0.09 to 2.16	0.319	17.60	0.85 to 2586.34	0.063	0.16	0.02 to 1.17	0.07

the risk of nosocomial infections and has been associated with increased patient satisfaction levels.[37] Collectively, our findings underscore the clinical significance of earlier discharge within the ERAS framework, improving patient safety and satisfaction while paving the way for continued innovation in TEBR.

Amidst data showing the link between increased postoperative narcotic dosages and the risk of chronic use,[38–41] ERAS protocols have emerged as a potentially effective solution. Our findings support this concept, demonstrating a 47% reduction in opioid usage in the ERAS cohort during the full inpatient period. This trend continued when controlling for ERAS' ability to decrease postoperative stay, as a 44% decrease in MME was seen in the POD 0-1 period. Building on these findings, our multivariable analysis further substantiates the effectiveness of ERAS protocols in opioid reduction for TEBR patients. Notably, after adjusting for prepectoral tissue expander placement, the protocol independently accounted for a 60.7 MME decrease in opioid consumption throughout the inpatient period. In this model, prepectoral implant placement was also an independent predictor of decreased narcotic use, responsible for a more modest 30.9 MME decrease over the same timeframe. Additionally, the ERAS cohort exhibited significantly reduced pain levels on POD0 and POD1. However, the reduction in postoperative pain observed in our study coincided with significant changes in surgical practice, including the adoption of the ERAS protocol in April 2019 and the introduction of prepectoral TEBR techniques in January 2018. Given that prepectoral placement avoids the need for submuscular dissection, resulting in inherently less pain,[23–27] our multivariable analysis identified this placement technique as the sole predictor of reduced pain scores. In addition to the dramatic inpatient findings, our data also indicated a substantive decline in the quantity of narcotics prescribed at discharge, with a median decrease of 225.0 MME when the ERAS protocol was used.

While reduced LOS is advantageous, premature discharge can precipitate compromised patient outcomes, negating intended improvements. This paradox underscores the necessity for surveillance of perioperative outcomes post ERAS implementation. Our assessment of postoperative complications illustrated findings that parallel other ERAS TEBR studies.[19–22] Specifically, the rates of cellulitis/infection and wound-related complications were similar between the cohorts, suggesting no increased risk associated with the ERAS protocol. Notably, the ERAS cohort exhibited an increased incidence of hematoma and seroma formation. The increased incidence of hematoma is surprising, given that the ERAS patients were more frequently prepectoral, requiring a more limited dissection. We postulate that the administration of nonsteroidal anti-inflammatory drugs (NSAIDs), known to impair platelet function, may have augmented the hematoma prevalence. Although this rationale is logical, consensus in the literature remains inconclusive.[42] The increase in seroma rates within our ERAS cohort coincides with a practice shift toward prepectoral expander placement. This procedural variance emerged as the singular significant variable in predicting seroma development.

Limitations

Our study's insights on ERAS protocols in TEBR must be considered within the context of several limitations. One notable limitation is the single-center design, which may not reflect the diverse practices and patient demographics of other institutions. Second, only complications documented within 90 days postoperation in our institutions' records were considered; thus, this analysis excluded any late-onset complications or those treated elsewhere. Additionally, it is important to acknowledge the differences between the groups studied: before 2018, our institution primarily used subpectoral placement for tissue expanders. As a result, the ERAS cohort exhibited a significantly higher incidence of prepectoral placement. Although multivariable analyses were used to address these differences, the inherent dissimilarity in expander location between the ERAS and pre-ERAS cohorts introduces a methodological limitation. Furthermore, the adjusted

R^2 values from our linear regression models merit a nuanced interpretation aligned with our study's aims. These models were used to discern the distinct effects of ERAS presence and prepectoral implant placement on postoperative outcomes. Our methodology for selecting variables led us to include these two variables exclusively due to their clinical importance.[23–26,29] Consequently, the lower variance noted in our results is justifiable. Although the modest R^2 values imply the existence of other influential factors, the purpose of the models was to provide insights into the independent effects of these two key variables. Finally, the prospective data collection for the ERAS cohort versus the retrospective approach for the traditional cohort introduces potential bias. Despite these limitations, our study provides a comparative analysis from a sizeable, demographically similar cohort and controls for potential outcome confounders.

Recommendations

Incorporating ERAS into our TEBR practice involved integrating it with our electronic medical records and establishing a dedicated oversight team, including physicians, surgical residents, nurses, and a nurse practitioner specializing in PRS care. To facilitate this transition, we focused on training our team on ERAS principles and patient care techniques, highlighting the proven benefits of ERAS across different surgical fields. Regular interdisciplinary meetings and audits allowed us to address and resolve any challenges, ensuring protocol adherence and team coordination. Our recommendation for adopting ERAS is to form a multidisciplinary team committed to patient-centered care, continuous education, and systematic evaluation. This strategy has substantially improved ERAS pathway adherence and patient outcomes in our institution.

CONCLUSIONS

Our study reinforces the role of ERAS as a pivotal element in TEBR, markedly diminishing opioid consumption and hospital stay durations. These findings further validate the efficacy of the protocol and illuminate its potential to enhance postoperative care. Integrating ERAS into this surgical workflow can promote swift and effective recovery, while maintaining acceptable patient safety and satisfaction.

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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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