
Benefits of Multimodal Enhanced Recovery Pathway in Patients Undergoing Open Ventral Hernia Repair



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- BACKGROUND:** Use of Enhanced Recovery After Surgery (ERAS) pathways have evidenced improved outcomes in several surgical specialties. The effectiveness of ERAS pathways specific to hernia surgery, however, has not yet been investigated. We hypothesized that our ERAS pathway would accelerate functional recovery and shorten hospitalization in patients undergoing open ventral hernia repair (VHR).
- STUDY DESIGN:** Consecutive patients undergoing open major VHR using transversus abdominis release and sublay synthetic mesh placement, with use of our ERAS pathway, were compared with a historical cohort before ERAS implementation. Main outcomes measures were time to diet advancement, time to return of bowel function, time to oral narcotics, length of stay (LOS), and 90-day readmissions.
- RESULTS:** Between January 2014 and January 2015, 100 patients undergoing VHR with ERAS implementation were compared with a historical cohort. The ERAS group demonstrated significantly shorter times to liquid and regular diet: 1.1 vs 2.7 and 3.0 vs 4.8 days, respectively ($p < 0.001$). Furthermore, ERAS patients demonstrated significantly shorter times to flatus and bowel movement: 3.1 vs 3.9 and 3.6 vs 5.2 days, respectively ($p < 0.001$). Average LOS was reduced from 6.1 to 4.0 days ($p < 0.001$), and ERAS patients had significantly fewer 90-day readmissions, 4% vs 16% ($p < 0.001$).
- CONCLUSIONS:** A comprehensive ERAS pathway for major open VHR was implemented safely. Multimodal perioperative pain management, oral opioid-receptor blockade, and early feeding strategies resulted in accelerated intestinal recovery, shorter hospitalizations, and fewer readmissions. Use of our ERAS pathway appears to result in improved outcomes in patients undergoing open VHR. (J Am Coll Surg 2016;222:1106–1115. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)
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Across various surgical disciplines, Enhanced Recovery After Surgery (ERAS) pathways have gained traction in an effort to standardize patient care and accelerate

postoperative recovery.^{1–8} Chiefly, the components of these pathways function to mitigate the various metabolic, neuroendocrine, and inflammatory stress responses to an operation, minimizing morbidity and length of stay (LOS).¹ Key principles to foster accelerated recovery are optimal postoperative pain management and acceleration of functional intestinal recovery. These 2 tenets are the cornerstone of recovery pathways and serve to reduce overall hospital stay and therefore, costs.^{2,9} Although concerns about hastening patient recovery arose initially, early reluctance toward “fast-track” pathways has largely been alleviated as data consistently demonstrate safe and effective outcomes, most prominently in the colorectal literature.^{10,11} In the current medical and economic climate, improvements in patient care and cost reduction are of paramount importance across all specialties. The

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Abbreviations and Acronyms

| | |
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| ERAS | = Enhanced Recovery After Surgery |
| LOS | = length of stay |
| PCS | = posterior component separation |
| POD | = postoperative day |
| TAP | = transversus abdominis plane |
| TAR | = transversus abdominis muscle release |
| VHR | = ventral hernia repair |

ERAS pathways offer a straightforward and effective avenue to improve both metrics.

Although comprehensive pathways have been used by a number of surgical disciplines, there has been limited use in the field of ventral hernia repair (VHR). Complex hernia patients present formidable challenges to the surgeon, not only in the operating room, but also during perioperative management. We viewed this as an opportunity to create an ERAS pathway to improve our patient care outcomes and standardize care for this difficult cohort.¹² We hypothesized that implementation of this pathway would result in faster functional recovery and shorter hospitalizations in patients undergoing open VHR. Here we evaluate the outcomes of our ERAS pathway implementation in a large cohort of hernia patients undergoing major open VHR.

METHODS

After obtaining appropriate institutional IRB approval, we identified consecutive patients undergoing VHR along with the use of our previously published ERAS pathway.¹² Inclusion criteria were patients undergoing major open retromuscular VHR with posterior component separation (PCS) via the transversus abdominis muscle release (TAR) technique¹³ in addition to sublay synthetic mesh placement. Patients undergoing concomitant intestinal resection (excluding enterotomies), and/or ostomy manipulations were not placed on our ERAS pathway because this was considered a potential confounder for intestinal recovery. Additionally, patients requiring biologic mesh placement due to contaminated fields or other complexities preventing synthetic mesh reinforcement were not placed on the pathway because their increased risk for wound morbidity and other potential sequelae requiring prolonged hospital stay was also considered a potential confounder to the study. Furthermore, we excluded patients who remained intubated after their operation or those who required admission to an ICU postoperatively because, by definition, those patients would be unable to follow the pathway immediately

postoperatively. Overall, 62 (38%) patients did not meet inclusion criteria and were excluded from the study.

Use of ERAS at our institution was part of a continuous quality improvement project, so initial implementation of the pathway was a gradual process. Adherence to all components of the pathway among all medical staff took a period of several months to reach full compliance from all concerned parties (preadmission testing, perioperative team, anesthesia, and housestaff). For this study, we included patients undergoing VHR once full ERAS adherence occurred. The study cohort (ERAS group) was compared with a historical control of patients undergoing the same technique of VHR before implementation of the ERAS pathway (control group). The historical cohort consisted of consecutive patients undergoing retromuscular VHR with PCS via TAR using synthetic mesh placed as a sublay. Patients with concomitant bowel resection, ostomy manipulations, biologic mesh placement, postoperative intubation, and ICU admission were excluded, as with the ERAS cohort. All procedures before and after ERAS implementation were performed by the same surgeons at our tertiary hernia care center.

Pertinent demographic data collected prospectively included age, sex, BMI, American Society of Anesthesiologists (ASA) class, and other comorbidities. Hernia characteristics included hernia size, hernia width, mesh size, and proportion of patients with recurrent hernias. Other outcomes measures were LOS, 90-day readmission rate, and cause of readmission.

The primary outcomes to determine functional recovery were time to return of bowel function, including flatus, bowel movement, and time to GI3 stage (time to toleration of solid food and bowel movement). Additionally, we analyzed time to advancement to oral liquids, time to oral solids, and proportion of patients with emesis after diet introduction. Times to oral narcotic analgesia and Foley catheter removal were also noted. These data were collected retrospectively using progress notes, medication administration notes, and nursing documentation.

Ventral hernia repair Enhanced Recovery After Surgery pathway

Development of our hernia-specific ERAS pathway was part of a continuous quality improvement project at our institution. Our initial hernia ERAS pathway¹² was based on the foundations set forth by Delaney and colleagues¹⁴ and their use in colorectal surgery at our institution. We then modified the components to fit large hernia operations as compared with colorectal resections, as outlined. [Table 1](#) summarizes our ERAS pathway compared with pre-pathway routine care for VHR.

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