Enhanced Recovery Pathways: Looking Into the Future

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espite significant advances in perioperative care, postoperative complications remain significant.^{1,2} Enhanced recovery after surgery (ERAS) programs introduced 2 decades ago include multidisciplinary, evidence-based interventions in preoperative, intraoperative, and postoperative care that work synergistically to mitigate the undesirable effects of the surgical stress response.^{3,4} Implementation of ERAS pathways has been shown to reduce postoperative complications and accelerate recovery in Europe as well as in the United States several years ago.⁵ In addition, ERAS pathways allow standardization of perioperative care that minimizes variability and improves perioperative outcomes.^{3,6} However, adoption of these evidence-based ERAS pathways in routine clinical practice has been surprisingly slow,⁷ although they should become standard of care for a variety of surgical procedures. Thus, there remains a delay in integrating the ERAS principles into a day-to-day clinical practice probably due to inadequate knowledge, inability or wish to change due to too many components, or lack of clinical leadership.⁴

In an effort to expand the implementation of ERAS pathways and improve perioperative care, the Agency for Healthcare Research and Quality in collaboration with the American College of Surgeons and Johns Hopkins Medicine Armstrong Institute for Patient Safety and Quality designed the "Safety Program for Improving Surgical Care and Recovery," with plans to introduce this plan in approximately 750 hospitals throughout the United States. The proposed surgical-related components of this program have been recently reviewed,8 while the proposed anesthesia-related components will be published in a subsequent issue of Anesthesia & Analgesia.9 Such efforts should improve patient care, reduce perioperative complications, and enhance recovery, and thus reduce health care costs. In addition, the information gathered from its widespread implementation should help address the current knowledge gaps in a broader group of patients and

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hospitals (eg, academic and nonacademic, urban and rural, and big and small).

For such a large-scale project to be clinically successful as well as to provide meaningful information that could be applied to future clinical practice, it is necessary that the components included in the protocols are updated as new evidence becomes available. Several components proposed initially in the guidelines were based on evidence obtained from outside fully implemented ERAS programs, and thus may not be applicable within the updated ERAS program.^{4,10} Furthermore, several components were based on theoretical benefits and lack definitive clinical evidence. Also, some of the components are procedure specific but have been applied universally for all procedures. Therefore, it is not surprising that several components that were initially thought to be critical are not considered essential (eg, preoperative administration of complex carbohydrate, μ -opioid receptor antagonist [ie, alvimopan, which provides no benefits in laparoscopic procedures¹¹ or in an opioid-sparingbased analgesic regimen], thoracic epidural for laparoscopic approach, and routine use of goal-directed fluid therapy). Similarly, mechanical bowel preparation in combination with oral antibiotics is now being recommended based on updated evidence of reduced surgical site infection, despite potential physiological derangement. This emphasizes that implementation of an ERAS program is a dynamic process. Thus, some of the components currently proposed by Ban et al⁹ may not be applicable when the program is actually implemented or during its course.

It is well recognized that adherence to the ERAS components impacts postoperative outcome and recovery.¹²⁻¹⁴ However, most studies report overall (and rather low) compliance rate, and thus, overlook the evidence that not all components are equally weighted with regard to their influence on recovery. Similar to previous studies,⁴ recent studies have reported that postoperative recovery is primarily influenced by minimally invasive surgical approach (eg, laparoscopic approach) and postoperative components such as early oral intake and early ambulation.^{13,14} Therefore, it is suggested that the focus on future ERAS programs initially should be on these components.⁴ However, anesthesia-related components, particularly the pre- and intraoperative anesthetic and analgesic techniques, hemodynamic management, temperature control, and approach to mechanical ventilation are generally inadequately evaluated in the ERAS setting probably because most of the studies assessing compliance are performed by surgeons.

Unfortunately, few studies have specifically evaluated the influence of anesthesia-related components on postoperative

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outcome. In this issue of *Anesthesia & Analgesia*, Grant et al¹⁵ report that increased compliance with anesthesia-influenced process measures is also associated with reduced hospital length of stay. Interestingly, even though this was a single institution study, the overall compliance rate was low. Furthermore, this study did not account for components influenced by surgeons, thus repeating the oversight of the studies performed by surgeons. This approach is contradictory to the ERAS principles that emphasizes breaking traditional silos among anesthesiologists, surgeons, nurses, pharmacists, and other personnel involved in perioperative care.^{3,16}

Importantly, several components under anesthesia control have for a long time been considered as standard of care including preoperative interventions such as optimization of comorbid conditions, avoidance of prolonged preoperative fasting and adequate oral hydration during the short fasting period, and detailed procedure-specific information. Similarly, several intraoperative components such as maintenance of normothermia, antibiotic prophylaxis, avoidance of fluid overload and hypovolemia, ventilation management, nausea and vomiting prophylaxis, and glycemic control are now considered standard of care. Other anesthesia-related factors that may influence postoperative outcomes include deep anesthesia, total intraoperative opioid dose, and incomplete reversal of neuromuscular blockade. However, the effects of these factors are not adequately assessed within an ERAS setting. Also, intraoperative hemodynamic management, which may influence postoperative outcome, has not been considered sufficiently in the analyses.

Unfortunately, there remains significant controversy regarding the anesthetic technique (ie, inhalation versus total intravenous anesthesia) and intraoperative opioid administration (ie, opioid sparing versus opioid free). In an effort to avoid or limit intraoperative opioids, several analgesic adjuncts (eg, intravenous lidocaine, ketamine, dexmedetomidine, and magnesium infusions) are often used either alone or in combination. However, the efficacy of these drugs compared to basic analgesic technique (eg, local/regional analgesia, acetaminophen, nonsteroidal anti-inflammatory drugs/ cyclooxygenase-2 specific inhibitors, and dexamethasone) as well as their potential adverse effects on postoperative outcome remain unknown.¹⁷ It must be emphasized that there is no good evidence to suggest that one anesthetic technique is superior to another, including for prevention of postoperative nausea and <u>vomiting</u>.¹⁸ Similarly, there is no good evidence to suggest that an opioid-free technique is superior to an opioid-sparing approach. Therefore, insistence on one technique over another (eg, total intravenous anesthesia) may be misunderstood by an average practitioner as the best approach or may result in a higher noncompliance rate, and may delay recovery from unidentified adverse effects.

In summary, large-scale implementation of a multidisciplinary ERAS program is a rapid and effective approach to improve surgical outcomes and reducing health care costs. However, it is critical that the ERAS protocols are updated regularly to integrate new evidence. Although it will be necessary to adapt these protocols for individual hospitals, the deviation from a pragmatic optimal approach should be minimal. Based on the current evidence, the core components for the success of an ERAS program include the use of a minimally invasive surgical approach and avoidance of drains, nasogastric tube, and urinary catheter, patient/ family education, avoidance of fluid overload/underload, procedure- and patient-specific nonopioid multimodal pain management to reduce interference with functional outcomes, early oral intake, and early mobilization.⁴

Although significant knowledge has been gained over the past 2 decades, several controversies remain. Future studies assessing the influence of individual ERAS components on postoperative outcome must be procedure specific and approach specific (ie, open versus minimally invasive approach), with the inclusion of updated evidence in a fully implemented ERAS program.

The areas that remain deficient include implementation of optimal anemia management, intra- and postoperative blood transfusion management, and prevention and management of postoperative fatigue, delirium, and cognitive dysfunction. In addition, preoperative risk stratification of patients at high risk for developing procedure-specific complications that influence postoperative course should allow implementation of specific interventions and improve outcomes. Also, perioperative pharmacological approaches to curtail undesirable surgical inflammatory responses (eg, high dose steroid administration) need further exploration.

In recent years, failure to rescue, defined as the inability to rescue a patient from major perioperative complications, resulting in mortality, has been identified as one of the major consequences of variability in postoperative care, particularly for high-risk surgical procedures.¹⁹ Failure to rescue rates presents an opportunity for improvement in patient outcomes. Therefore, it is necessary to characterize the variables that contribute to this phenomenon, which would allow interventions to improve failure to rescue rates.¹⁹

It is necessary to identify the reasons for delayed milestones such as oral intake and/or ambulation (eg, suboptimal implementation of ERAS protocol due to logistic or administrative issues or the occurrence of medical and/ or surgical complications that may lead to deviation from protocol). The role of nursing care in facilitating early oral intake and ambulation is essential as well as role of postdischarge environment (eg, social circumstances) must be assessed. Most studies have defined a successful enhanced recovery based on postoperative complication rate, hospital length of stay, and readmission rate. However, these outcomes do not necessarily define recovery from the patients' point of view, which is return to preoperative functional level (ie, activities of daily living). Therefore, it is necessary to assess the influence of ERAS programs on patients' postdischarge functional recovery.²⁰

Finally, the role of the anesthesiologist in facilitating the development and implementation of ERAS program is critical, but it needs to be within a multidisciplinary approach. There is an urgent need for well-designed, procedure-specific, and adequately powered studies identifying the components directly under the purview of the anesthesiologists but outside the current standard of care, which influence postoperative outcome.

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