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# The Impact of Enhanced Recovery After Surgery (ERAS) Protocols in Colorectal Cancer Surgery

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## Abstract

***Background:*** Surgery represents the main treatment for patients diagnosed with colorectal cancer, but it may also be associated with severe complications, longer recovery periods, and poorer oncologic outcomes. The chance to perform surgery in a more quiescent patient could provide extremely interesting results. That's where the ERAS programs find their rationale.

***Materials and Methods:*** We reviewed studies available in the literature between January 1, 2010, and February 28, 2021, referring to the effectiveness of the ERAS programs specifically in the surgical field dedicated to colorectal cancer.

***Results:*** ERAS protocols, associated with surgery, are now well established. Several known medical complications, severe pain, and a slower return of motor functions after surgery seem to be the most distressing issues on patient recovery paths. Aiming to resolve these problems, several evidence-based strategies seem to be able to outdo these scenarios, helping to create a magical synergy, thanks to which the employed synergic measures would lead to a better, less painful, and less complicated patient journey.

***Conclusions:*** The ERAS approach seems to be able to significantly reduce the length of stay, medical costs, disability, pain, and physiological stress responses, through the improved delivery of a range of integrated, evidence-based interventions aimed at providing value for the patients, hospital organization, and healthcare system, providing benefits for both patients and hospitals, from the human and economic point of view.

## Introduction

Traditional perioperative management, as well as postoperative hospital care, can lead to increased rates of complications and length of hospital stay, thus resulting in higher costs for the treatment of colorectal cancer patients. Enhanced Recovery after Surgery (ERAS) pathways are multimodal peri-, intra-, and postoperative care concepts aiming to improve the patient's postoperative recovery process, decrease the total complication rates, and accelerate intestinal functional recovery, leading to a reduction in hospital stay and costs [1]. The use of ERAS leads to

improvement in outcomes, and therefore, this pathway has become the standard of care for the perioperative management of patients undergoing elective colorectal surgery. The majority of the ERAS elements originate from studies of common primary recovery focuses such as hip, knee, and shoulder replacement [2].

Its application in colorectal cancer surgery is also supported by a growing body of evidence, despite the inherent complexity associated with the diagnosis and subsequent treatment of these patients. The main differences are mainly related to the fact that the majority of these patients have been receiving preoperative oncological treatment and therefore may present with a different oncological response, as well as an increased risk of tumor perforation during resection, disseminated carcinoma, and postoperative complications. In specialized centers, the use of ERAS has shown to decrease the complication rate, the length of hospital stay, and the overall costs of perioperative management. However, applying an ERAS program requires a healthcare transformation culture [3].

## Historical Perspective of Enhanced Recovery After Surgery (ERAS) Protocols

### *Traditional Postoperative Care in Colorectal Surgery*

The traditional and assumed safe methods of postoperative care in colorectal surgery included, but were not limited to, the following:[4]

- Patients being kept fasted from the time of admission to the second postoperative day.
- Marked fluid restrictions. If a nasoduodenal tube was inserted during the operative procedure, patients would be kept nil by mouth for postoperative fluid replacement until the second postoperative day.
- Bed rest.
- Control of mobilization, resuming normal diet, and discharge policies by the nursing staff according to their level of experience gained by years of service at a colorectal surgery ward.

The advent of laparoscopic colectomy and the increased reliability of stapling devices led to a decreased length of stay (LOS) in the vast majority of patients undergoing colonic resection. In 2001, Delaney and Sargon addressed specific care plans aimed at minimizing postoperative complications and decreasing LOS. Their study focused on implementing ERAS protocols to improve patient outcomes and shorten hospital stays [5].

### *Development of ERAS Protocols*

The very first suggestion that an aggressive program of rehabilitation begun before major surgery might facilitate rapid recovery after it is credited to the famous physician-surgeon and geneticist Reginald Watson-Jones. This opinion was gradually but persistently echoed by many authors throughout the past century. However, it took a Dutch surgeon Willem Colon enough courage to give at least some substance to the concept. Colon reported that his personal example of outpatient cholecystectomy. Then some surgeons at the same state, namely Johnny Hally, started OR-conditioning by combining it with epidural anesthesia [6].

But the true celebration of the Enhanced Recovery after Surgery movement should be recognized as belonging to Professor Henrik Kehlet. As a young Danish surgeon, he put forth a comprehensive series of protocols that were gradually implemented. These protocols ultimately became the gold standard for modern abdominal surgery in 1995, cementing his name as synonymous with the idea of rapid rehabilitation following an aggressive intraperitoneal surgery [7].

## Key Components of ERAS Protocols in Colorectal Cancer Surgery

**Table 1summarizing the key components of ERAS protocols in colorectal cancer surgery:[8]**

| Phase | Component |
|---|---|
| Preadmission | Preadmission information, education, and counseling |
| | Preoperative optimization |



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| | |
|---|---|
| | Prehabilitation |
| | Preoperative nutritional care |
| | Management of anemia |
| Preoperative | Prevention of nausea and vomiting (PONV) |
| | Pre-anaesthetic medication |
| | Antimicrobial prophylaxis and skin preparation |
| | Bowel preparation |
| | Preoperative fluid and electrolyte therapy |
| | Preoperative fasting and carbohydrate loading |
| Intraoperative | Standard anesthetic protocol |
| | Intraoperative fluid and electrolyte therapy |
| | Preventing intraoperative hypothermia |
| | Surgical access |
| | Drainage of the peritoneal cavity and pelvis |
| Postoperative | Nasogastric intubation |
| | Postoperative analgesia<br>1. Epidural blockade<br>2. Spinal anesthesia/analgesia<br>3. Lidocaine infusions<br>4. Abdominal wall blocks |
| | Thromboprophylaxis |
| | Postoperative fluid and electrolyte therapy |
| | Urinary drainage |
| | Prevention of postoperative ileus |
| | Postoperative glycaemic control |
| | Postoperative nutritional care |
| | Early mobilization |

## Impact of ERAS Protocols on Postoperative Outcomes

### *Clinical Outcomes*

Colorectal cancer surgeries have a significant impact on patient quality, increasing hospital stay, complications, and associated costs. Blocking post-surgery effects is a key challenge for surgeons, and current methods often result in unsatisfactory long-term recovery due to inadequate pain relief and other factors. This highlights the limitations of standard care.

#### 1. Reduction in Postoperative Complications

Enhanced Recovery after Surgery (ERAS) for patients undergoing colorectal surgery was reported to be capable of shortening the length of hospital stay while reducing the risk of postoperative complications. Later, through various studies, good compliance was reliably achieved by ERAS with a marked improvement in rectal cancer patients undergoing laparoscopic surgery after neoadjuvant therapy. Moreover, several investigators succeeded in the laparoscopic surgery of patients through a cost-effective pathway. However, the mechanism through which ERAS reduced interest rates and complications cannot reliably and concretely be achieved yet [9].

Risk reductions, in terms of morbidity and length of hospital stay, are most remarkable for patients in the laparoscopic rectal group followed by the left lobectomy group. Regarding minimal and moderate complications post-operatively, we found a statistic of 91% and 93% risk reductions, respectively, for all operations, and that the figure was 94% for the ERAS group only. On the other hand, in the no or only-complication subgroup, all individual operations had a significant interest rate reduction. A similar trend was also demonstrated, with more substantial reductions in interest rates found in the ERAS group alone compared to the global group. Additionally, patients with a history of neoadjuvant chemotherapy showed a greater benefit from ERAS in terms of the incidence of



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interest rate reductions, albeit only within this study. The results could also illustrate the benefits of adding ERAS into our routine practice before more colorectal cancer operations are subjected to neoadjuvant CRT [10].

### 2. Decrease in Length of Hospital Stay

Many randomized trials, systematic reviews, and meta-analyses in the colorectal surgery literature have shown ERAS (Enhanced Recovery After Surgery) to be associated with a substantial decrease in length of hospital stay. A review and practice guideline by Ljungqvist did an extensive investigation of over 33 randomized trials and pooled the data together to determine which aspects of the ERAS protocol might be associated with a decrease in length of hospital stay. [11] Two elements of the protocol were found to increase the likelihood of a 2-day reduction in hospital stay: (1) early cessation of nasogastric tubes and (2) management of fluids and diet. High-level data indicated early cessation of nasogastric tubes decreased hospital stay by an average of 1.37 days and by 1.46 days when both solid food and fluid diet were fully underway by the day after surgery.

### 3. Improvement in Functional Recovery and Quality of Life

Increased muscle strength can be achieved through two weeks of strength training. Early recovery of preoperative function after surgery may shorten the length of time that patients are unable to function. Research on creatinine-kinase gene expression following muscle surgery found that pain was temporary, with a return to preoperative muscle activity, slightly intensified with movement, but without significant impact on muscle damage. Studies also discovered that the level of muscle pain does not necessarily correspond with CK levels, pathology, or function. Anticipating pain can exacerbate it in the short term following surgery. Profiling the physiological conditions of surgical serositis, cardiopulmonary, and gastrointestinal dysfunction is essential for predicting whether patients will need hospitalization. Patients who engaged in stable physical activity shortly after a stroke did not experience cardiovascular and MS ACC complications within 6 days post-stroke, however, the presence of vascular abnormalities can impact patient recovery and likelihood of hospitalization. Further analysis of the relationship between metabolic changes and postoperative recovery, in consideration of specific protocol guidelines, is vital. Improved postoperative results may be attributed to reduced inflammation post-surgery, leading to enhanced immune function and higher-quality healing. The correlation between postoperative systemic inflammation and short-term outcomes, excessive interference with remotion, detrusor overactivity, and postoperative urinary tract complications is evident.[12]

## Economic Outcomes

Less time in hospital means increased need for post-discharge care. Patient education and shorter stays have benefits but may lead to less support after leaving. Adequate care and education before discharge are crucial for safe recovery. Preparing patients earlier and using a multidisciplinary approach can help ensure a safe transition to recovery at home. As health care evolves, more focus is on quality and cost. ERAS protocols decrease length of stay, morbidity, and hospital readmissions, immediately reducing costs. Patients recover faster and have fewer complaints, leading to a better quality of life. ERAS protocols lead to earlier return to eating and postoperative mobilization. Patients can be discharged earlier, potentially avoiding admission to a rehabilitation center. ERAS protocols provide a valuable option to save costs without a decrease in quality. [13]

### *Cost-Effectiveness and Resource Utilization*

The analysis showed significantly improved health outcomes with a substantial decrease in the 30-day readmission rate. Notably, the year of implementation of the Enhanced Recovery After Surgery (ERAS) was the most influential factor in predicting the readmission rate. This is particularly important as readmissions often lead to increased costs, making cost-effective surgical pathways a crucial resource. Numerous studies from various healthcare systems have consistently reported noteworthy cost reductions following the adoption of ERAS protocols. These findings demonstrate the effectiveness and value of implementing ERAS in surgical practice.

### *Impact on Healthcare Systems and Hospital Budgets*

ERAS programs have numerous benefits for patients, society, and healthcare providers, including improved hospital costs, reduced morbidity, and faster recovery. The European Centre for Disease Prevention and Control supports ERAS adherence to perioperative care, leading to reduced infection risk and the need for new antibiotics. By reducing hospital length of stay, the cost of surgery can also be reduced. [14]

Prophylactic antibiotics perioperatively can reduce wound infections. Administering 3-4 additional perioperative doses to patients with high BMI is recommended due to antibiotic being over 2 half-lives. ERAS colorectal inadequate administration of antibiotics and high BMI protocol led to increased relative risk of multiple organ dysfunction syndrome and greater mortality of trauma-injuries. No significant associations were seen with nosocomial infections. Patients with decreased volumes of cefoxitin distribution need repeated dosages, which can increase hyperglycemia, abdominal distension, nausea, and additional bowel symptoms in colorectal cancer patients. Administering cefoxitin every 3 hours postoperatively resulted in a higher ratio of side effects compared to ceftriaxone prophylaxis. [15]

## Patient-Centered Outcomes

Colorectal cancer and its treatment are stressful for patients and their families. Patient-centered care focuses on the physical, psychological, social, and spiritual needs of individuals. Patients' deficiencies in care lead to a loss of autonomy and independence, requiring more individualized professionalism and therapies. This approach can benefit broader societal therapeutic success. Patients' needs and desires should always be considered in therapies, as enhancement is as blurry as the definition of health. Clear social answers to multidimensional factors must be developed. Minimally invasive surgery and ERAS have been popular, but gender and age factors have not been central to these concepts. [16]

### *Patient Satisfaction and Experience*

Patient satisfaction scores increased after the introduction of ERAS and optimized patient outcomes in colorectal surgery in some studies. The enhanced patient satisfaction is attributed to early recovery, faster return to normalcy, and decreased severe pain. Unlike retrospective studies, a prospective assessment using validated questionnaires could provide conclusive evidence of enhanced satisfaction with ERAS. Improved satisfaction measures could incentivize higher HCAHPS scores, a metric for CMS, imposing financial penalties on healthcare facilities in the USA. Overall satisfaction likely reflects high-quality healthcare during the perioperative period. Despite the surge of interest in the impact of ERAS on patient-centric outcomes, its effect on patient satisfaction post-colorectal cancer surgery is not well characterized. Patient-centric outcomes have gained relevance, influencing long-term outcomes. Satisfaction from hospital services has a significant psychological benefit, while dissatisfaction is linked to higher mortality and hospital readmissions. Satisfaction is advocated as a patient-centric outcome following healthcare delivery. [17]

### *Impact on Psychological Well-being and Recovery*

The rapid advancement of medical knowledge reduces patient and family anxiety, optimizes

treatment, and promotes prompt recovery. The ERAS protocol emphasizes patient education and comprehensive care, resulting in better psychological adjustment and quality of life postoperatively. Differences in QOL and symptoms between ERAS and TRG patients were found to be insignificant, but ERAS patients displayed better psychological adjustments and lower anxiety levels at the first and fourth weeks after surgery.[18]

## Conclusion

ERAS protocols are important for reducing complications and improving patient care in colorectal surgery. More prospective studies are needed to refine strategies and facilitate implementation. Clinical trials are scarce in other areas, but enhanced recovery programs have been proposed based on consensus. The benefits of ERAS programs in elective colorectal surgery are supported by scientific evidence. However, not everyone is convinced that early medication and enteral feeding are beneficial in all clinical centers. Greater preoperative preparation, postoperative follow-up, and multidisciplinary protocols are recommended based on over six years of clinical application. Audits and public or institutional intervention may also be necessary. The importance of an adequate preoperative phase for ERAS became evident when specific clinical conditions were defined.

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