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DOCTORAL THESIS
(PhD Thesis Summary)
ILEOSTOMY IN MINIMALLY INVASIVE RECTAL
RESECTIONS

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1. Introduction

1.1. Current Oncological Context and Relevance of the Topic

Rectal cancer represents a significant global public health issue, ranking among the most frequent gastrointestinal malignancies. In recent years, there has been a concerning rise in its incidence, including among individuals under 50 years of age, in the context of lifestyle changes, genetic predispositions, and increased exposure to carcinogenic agents. Simultaneously, the remarkable progress in multimodal oncological treatment – including neoadjuvant therapies, advanced surgical technologies, and standardized care protocols – has redefined therapeutic goals, shifting the focus from mere survival to functional preservation and improvement in quality of life [1, 2, 3].

In this context, the present thesis addresses a topic of utmost interest: optimizing surgical decision-making in the treatment of rectal cancer through objective assessment of the need for temporary protective ileostomy in the era of minimally invasive surgery.

1.2. The Impact of Minimally Invasive Surgery in Rectal Cancer

Minimally invasive surgery has become the gold standard in the oncological approach to the rectum, due to its multiple proven advantages, including reduced postoperative morbidity, faster recovery, shorter hospitalization, and comparable oncological outcomes to those of open surgery. Techniques such as advanced laparoscopy, transanal approaches (TaTME), and robotic surgery have enabled precise total mesorectal excision (TME) even in anatomically challenging cases or those involving low-lying tumors [2, 6].

In this modernized context of rectal surgery, where oncological standards can be achieved with reduced functional impact, reevaluating traditional decisions—such as the routine use of protective ileostomy—is not only timely but necessary.

1.3. The Role of Temporary Ileostomy and Current Controversies

Protective ileostomy is widely used to mitigate the clinical impact of a potential anastomotic leak. Although it does not prevent the occurrence of the leak, it allows for conservative management of complications, thus avoiding major reinterventions in selected

cases. However, ileostomy is not without risks: electrolyte imbalances, dehydration, altered body image, delayed digestive reintegration, and even psychosocial complications [130].

Current controversies in the literature center around the need to redefine indications for ileostomy based on objective assessment of risk factors and individual clinical context. The systematic use of ileostomy is increasingly being questioned, and modern practice calls for a rational and personalized approach.

1.4. The Need for a Personalized Decision-Making Protocol

In the absence of universally accepted standardized criteria, the decision to perform a temporary ileostomy often remains subjective, influenced by the surgeon's experience and intraoperative circumstances. This variability leads to inconsistent practices and the risk of under- or overtreatment.

Therefore, there is a pressing need to develop an objective, statistically validated decision-making protocol that can integrate tumor-related, biological, and technical factors into a stratified score. Such a tool would enable standardized decision-making and reduce the need for routine ileostomy procedures without compromising oncological safety or functional outcomes. This thesis addresses precisely this urgent need in current clinical practice.

1.5. General Objectives of the Thesis

The aim of this doctoral thesis was to investigate the role of temporary ileostomy in minimally invasive rectal surgery, with the goal of developing and validating an objective decision-making protocol. The general objectives were:

- To clinically and statistically analyze a cohort of patients undergoing minimally invasive rectal resections, in order to identify factors influencing the decision to perform ileostomy.
- To evaluate the impact of ileostomy on postoperative biological balance and quality of recovery.
- To investigate how full implementation of the ERAS protocol may influence the need for ileostomy and postoperative outcomes.
- To propose and test a decision-making protocol based on objective factors, with potential for implementation in current surgical practice.

Through these objectives, this thesis aims to make a meaningful contribution to the optimization of rectal cancer treatment and the personalization of surgical decision-making in the era of minimally invasive technology.

2. Current State of Knowledge

2.1. Relevant Anatomy and Physiology of the Rectum and Ileum for Oncologic Surgery

The rectum, the terminal segment of the digestive tract, has a complex anatomy and crucial pelvic relationships essential for surgical oncologic planning. Its dual vascular supply, lymphatic drainage along the inferior mesenteric artery, and both autonomic and somatic innervation require meticulous dissection during total mesorectal excision (TME) [14].

The terminal ileum, the segment involved in the creation of an ileostomy, is physiologically specialized in the active absorption of water, electrolytes, and vitamin B12. When temporarily diverted, these functions are partially suspended, leading to significant fluid and electrolyte losses, especially in the early postoperative days, which increases the risk of metabolic complications, particularly in frail or hypoproteinemic patients.

2.2. Epidemiology, Etiopathogenesis and Classification of Rectal Cancer

Rectal cancer is one of the most aggressive and frequent neoplasms of the lower digestive tract, affecting mainly males aged 60 to 80. According to GLOBOCAN data, its incidence is rising, including among younger patients [23].

Its etiopathogenesis is multifactorial: environmental factors (high-fat diet, sedentary lifestyle, smoking), inflammatory bowel diseases, genetic predispositions (Lynch syndrome, FAP), and somatic mutations (KRAS, TP53, BRAF). The TNM classification (AJCC/UICC) remains the gold standard for staging, while the integration of radiologic and molecular data (CRM, TRG, MSI) enables a personalized approach to oncologic treatment [28, 29, 30].

2.3. Modern Surgical Techniques: LaTME, TaTME, Robotic Surgery

Minimally invasive techniques have revolutionized rectal surgery, ensuring oncologic radicality while minimizing tissue trauma. Laparoscopy allows precise anatomical dissection with enhanced visualization. In challenging cases (low tumors, narrow pelvises), the transanal

approach (TaTME) offers a direct “bottom-up” excision of the mesorectum, thereby reducing the risk of positive circumferential margins [48, 49].

Robotic surgery adds the advantages of superior maneuverability and 3D visualization, making it a viable solution for complex cases. All these techniques contribute to faster recovery and reduced complication rates but require individualized surgical decisions for each case.

2.4. Anastomotic Leakage – A Major Postoperative Risk and Preventive Strategies

Anastomotic leakage remains the most feared complication of rectal surgery, associated with morbidity, mortality, oncologic recurrence, and long-term dysfunctions. Risk factors include: low anastomosis, prolonged operative time, hypoproteinemia, preoperative radiotherapy, and local ischemia [83].

Modern preventive measures include intraoperative assessment of anastomotic perfusion using indocyanine green (ICG), carefully selected suturing techniques, and perioperative optimization protocols. Nevertheless, the incidence of leakage remains between 6–15%, justifying careful evaluation of each individual case [84].

2.5. The ERAS Protocol – Its Role in Recovery Optimization

The Enhanced Recovery After Surgery (ERAS) protocol in rectal surgery has demonstrated, through numerous multicenter studies, a reduction in hospital stay, postoperative complications, and improved quality of life. Its principles—preoperative nutrition, early mobilization, multimodal pain control, and avoidance of unnecessary drains and nasogastric tubes—align perfectly with the philosophy of minimally invasive surgery [103].

However, complete implementation of the ERAS protocol remains variable in practice. This thesis highlights that incomplete application is associated with longer operative times, slower rebalancing, and increased risk of ileostomy.

2.6. Ileostomy: Indications, Complications, Reversal

Temporary ileostomy is used to divert the fecal stream and protect low anastomoses. Indications include: anastomosis <5 cm from the anal verge, ASA score >2, albumin <3.5 g/dL,

or preoperative radiotherapy. However, ileostomy carries its own complications: electrolyte imbalances (hyponatremia, hypokalemia), protein losses, peristomal skin lesions, anxiety, and frequent readmissions [126].

The optimal timing for stoma reversal varies, ranging from 3 to 12 weeks; however, delays can negatively impact the quality of life. This thesis emphasizes the need for a thorough assessment of ileostomy necessity and the development of a personalized reintegration strategy [142].

2.7. LARS – Low Anterior Resection Syndrome

Low Anterior Resection Syndrome (LARS) is a common functional consequence following low rectal surgery. Symptoms include increased stool frequency, incontinence, urgency, and fragmented bowel movements—all of which severely affect quality of life [152].

The risk of LARS is influenced by anastomotic height, the presence of an ileostomy, and the timing of bowel continuity restoration. Evaluation tools, such as the LARS Score and COREFO, allow for an objective assessment of the impact. In this thesis, LARS is analyzed in relation to ileostomy and digestive reintegration strategy [153].

2.8. The Need to Redefine Indications for Ileostomy

The routine use of protective ileostomy is increasingly challenged in recent literature. Multiple studies have shown that a significant subgroup of patients can achieve favorable outcomes without an ileostomy, provided certain oncological, biological, and technical criteria are met.

Thus, there is a need for validated decision-making protocols that enable risk stratification for anastomotic leakage and rational application of ileostomy. This thesis proposes such a protocol, based on real-world clinical data, integrating a reproducible and clinically applicable scoring system.

3. Personal Contributions

3.1. Study I – Descriptive Analysis of Patients Undergoing Minimally Invasive Rectal Resections

3.1.1. Objectives, Methodology, and Study Population

The primary objective of this study was to characterize a homogeneous cohort of patients diagnosed with mid- and low-rectal adenocarcinoma who underwent minimally invasive rectal resection, in order to identify the clinical, biological, and technical factors associated with the decision to perform a protective ileostomy.

We aimed to:

- Evaluate tumor distribution according to location and stage;
- analyze the preoperative biological status;
- Describe intraoperative parameters;
- Quantify the frequency of ileostomies;
- and ultimately determine the predictive factors for this surgical decision.

The methodology involved a prospective–retrospective study on a cohort of **117 patients** operated on between **2016 and 2023** by the **same surgical team**, using either the LaTME or TaTME approach. Data were extracted from medical records, operative notes, and laboratory files.

The analyzed variables included:

- **Demographic factors:** age, sex, BMI
- **Biological parameters:** albumin, total proteins, hemoglobin, sodium, potassium
- **Oncologic data:** tumor location, TNM stage, post-radio-chemotherapy TRG score
- **Technical details:** operative time, surgical approach, presence or absence of ileostomy

Statistical analysis was performed using **SPSS v26**, applying descriptive methods, the **t-test** for continuous variables, the **chi-square test** for categorical data, and **logistic multivariate analysis** to identify predictive factors, with statistical significance set at **p < 0.05**.

3.1.2. Clinical, Biological and Technical Results

The studied population included:

- **34.2%** patients with **low rectal tumors**
- **65.8%** with **mid-rectal tumors**

Surgical approach:

- **82.9%** underwent **standard laparoscopic resection**
- **17.1%** underwent **TaTME**, indicated for low tumors and anatomically difficult pelvises

Distribution of Surgical Techniques Used

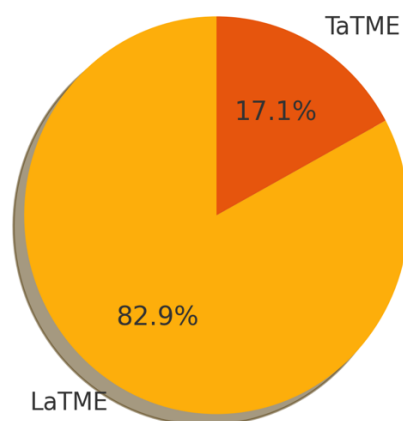


Fig. 1. Distribution of Surgical Technique Used

The preference for **LaTME** reflects the advantages of laparoscopy in rectal surgery, such as:

- enhanced visualization of anatomical planes
- shorter hospitalization
- lower risk of intraoperative complications

TaTME was mainly used in patients with very low rectal tumors or with complex anatomical conditions (narrow pelvis or bulky tumors). This technique enables a more precise

excision of the mesorectum, reducing the risk of positive circumferential margins and making it an ideal approach for distal rectal cancers.

Operative time:

- **<200 minutes** – 15.4%
- **200–300 minutes** – 37.6%
- **>300 minutes** – 47.0%

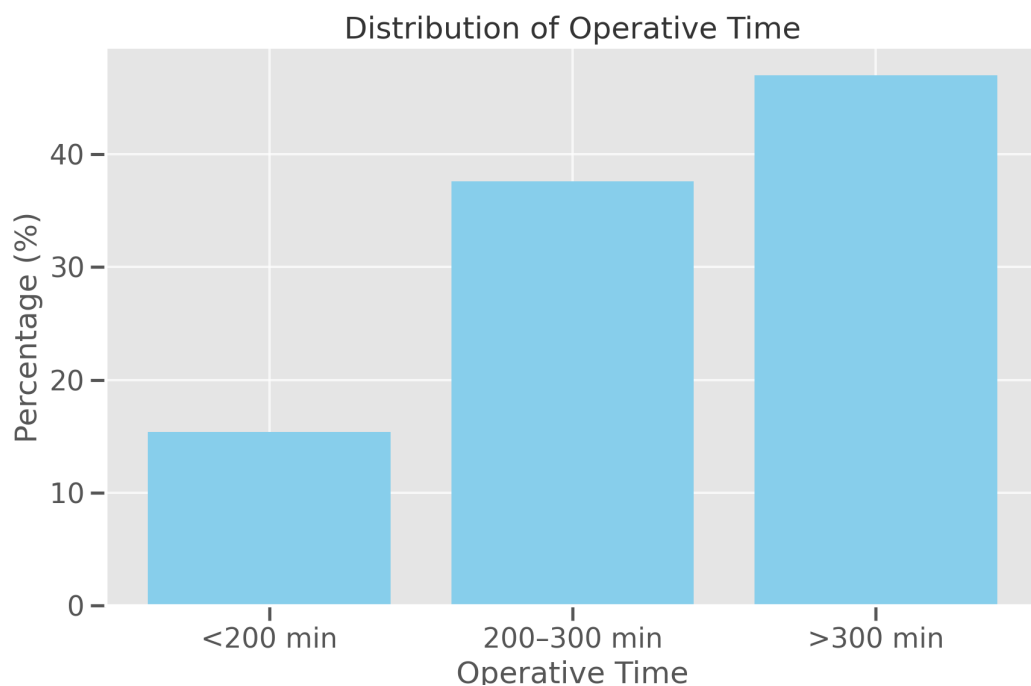


Fig. 2. Distribution of Surgical Duration

The majority of procedures exceeded 200 minutes, reflecting the complexity of minimally invasive surgeries in advanced rectal cancer. Longer operative times were associated with:

- The TaTME technique, which is time-consuming due to its dual approach (laparoscopic and transanal);
- very low rectal resections requiring meticulous dissection;
- advanced-stage tumors (IIIB and IIIC), requiring extensive excision

Operative duration may directly influence postoperative complications and the decision to perform a protective ileostomy.

Ileostomy frequency:

- **77.8%** of patients underwent **protective ileostomy**
- **22.2%** did **not** require ileostomy and experienced **no major complications**

Preoperative biological status:

- **Albumin <3.5 g/dL** – found in a significant portion of patients with ileostomy
- **Total proteins <6.5 g/dL**
- **Hemoglobin <10 g/dL** – correlated with longer operative time and technical difficulty

3.1.3. Correlation of Risk Factors with the Need for Ileostomy

Multivariate analysis revealed statistically significant associations between the decision to perform ileostomy and the following factors:

- **ASA score $\geq$ III**
- **Operative time >300 minutes**
- **Albumin <3.5 g/dL**
- **Very low tumors ($\leq$ 5 cm from the anal verge)**

All patients who developed postoperative anastomotic leakage had undergone protective ileostomy, which allowed for **conservative management** of the complication, avoiding major reinterventions.

On the other hand, patients without ileostomy—selected based on favorable risk assessment—had good clinical outcomes, confirming the feasibility of avoiding this procedure in carefully selected cases.

3.1.4. Preliminary Conclusions

Study I supports the idea that protective ileostomy should **not** be applied **routinely**, but rather **individualized** based on objective parameters. Unfavorable biological factors, operative time, and anastomotic level must all be considered in surgical decision-making.

The obtained results substantiated the need to develop a **standardized decision-making protocol**, which is further detailed and validated in **Studies III and IV**.

3.2. Study II – The Impact of Protective Ileostomy on Postoperative Electrolyte Imbalances

3.2.1. Analyzed Parameters and Biological Criteria

The objective of this study was to evaluate the impact of temporary protective ileostomy on hydro-electrolytic balance during the immediate postoperative period.

A total of **117 patients** with mid and low rectal adenocarcinoma were included in the analysis, divided into two groups:

- **Ileostomy group:** 91 patients
- **Non-ileostomy group:** 26 patients

For each patient, the following **biochemical parameters** were analyzed over the first 5 postoperative days:

- **Electrolytes:** sodium (Na), potassium (K)
- **Protein status:** albumin, total proteins
- **Hemoglobin (Hb)**
- **Ileal output volume** during the first 72 hours (for patients with ileostomy)
- **Time required for biological stabilization**
- **Need for corrective therapeutic interventions**

Statistical significance was set at **$p < 0.05$** , and the analysis was performed using **SPSS v26**, applying **t-tests** and **chi-square tests** where appropriate.

3.2.2. Significant Differences Between Groups With and Without Ileostomy

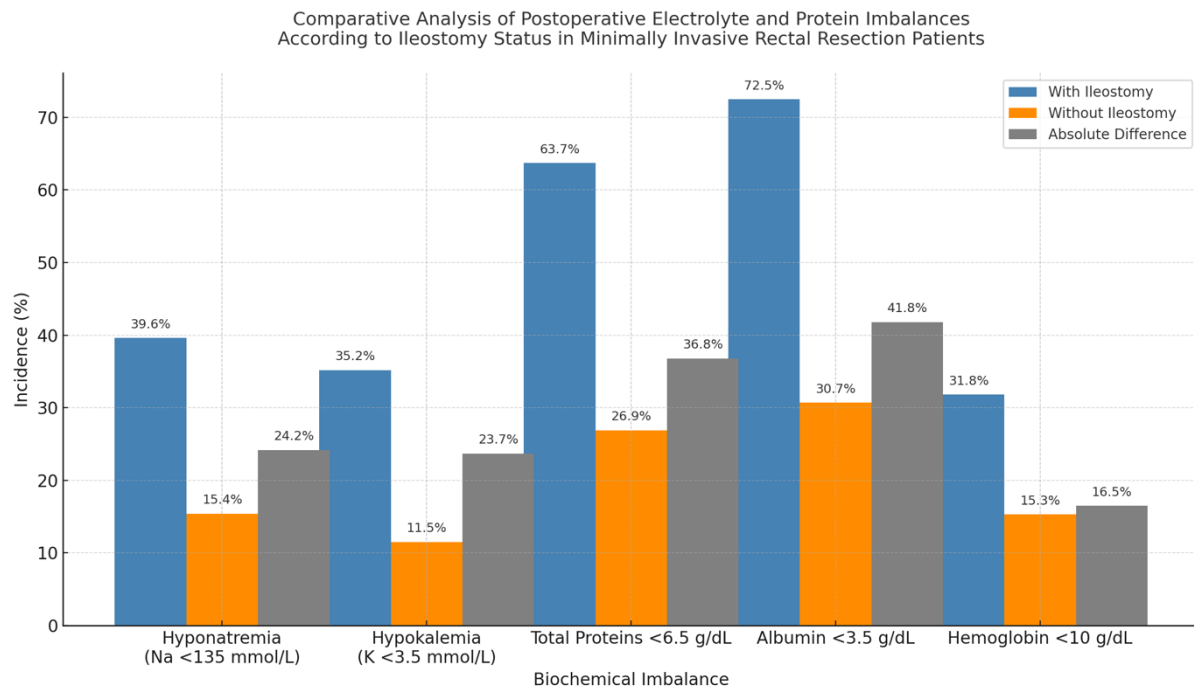


Fig. 3. Graph comparing the incidence of major postoperative biochemical imbalances in patients with and without protective ileostomy. A significantly higher frequency of hyponatremia, hypokalemia, hypoalbuminemia, hypoproteinemia, and anemia is observed in the ileostomy group. The additional column reflects the absolute difference between the two groups.

Compared to the non-ileostomy group, patients who underwent protective ileostomy showed a significantly higher incidence of the following biochemical imbalances:

- **Hyponatremia (Na <135 mmol/L):**
 - 39.6% in the ileostomy group vs. 15.4% without ileostomy (**p = 0.02**)
- **Hypokalemia (K <3.5 mmol/L):**
 - 35.2% vs. 11.5% (**p = 0.01**)
- **Total proteins <6.5 g/dL:**
 - 63.7% vs. 26.9% (**p < 0.01**)
- **Albumin <3.5 g/dL:**
 - 72.5% vs. 30.7% (**p < 0.01**)
- **Hemoglobin <10 g/dL:**
 - 31.8% vs. 15.3% (**p = 0.03**)

In **44%** of ileostomy patients, **ileal output exceeded 1500 mL/24h**, and this was significantly correlated with decreased serum proteins and worsening of electrolyte imbalances.

3.2.3. Clinical and Therapeutic Consequences

Patients with an ileostomy required **additional therapeutic interventions** in the postoperative period, including:

- **Intravenous electrolyte supplementation** (NaCl, KCl)
- **High-protein nutritional supplementation** (protein shakes/formulas)
- **Intensive biological rebalancing** in the intermediate care unit

The **mean time to biological stabilization** was:

- **3.1 days** in the ileostomy group
- **1.6 days** in the non-ileostomy group (**p = 0.02**)

The **30-day readmission rate** for hydro-electrolytic imbalances was:

- **9.8%** in the ileostomy group
- **0%** in the non-ileostomy group

These findings highlight the significant impact of ileostomy on biological homeostasis, particularly in patients with poor preoperative nutritional status.

3.2.4. Conclusions

Study II demonstrates that, although protective ileostomy is valuable in preventing severe complications from anastomotic leaks, it also leads to **significant postoperative biochemical imbalances**.

Patients with ileostomy are at increased risk of **hyponatremia, hypokalemia, hypoproteinemia, and anemia**, requiring **additional therapy, prolonged hospitalization**, and in some cases **readmission**.

These observations support the conclusion that objective **predictive factors should guide ileostomy decisions** and that patients selected for this procedure require **careful postoperative biological monitoring and support**.

3.3. Study III – The Impact of the ERAS Protocol on Perioperative Optimization

3.3.1. Degree of ERAS Protocol Implementation in the Study Cohort

The objective of this study was to assess the level of implementation of the **Enhanced Recovery After Surgery (ERAS)** principles among patients undergoing minimally invasive rectal resections and to analyze their impact on perioperative outcomes.

The ERAS protocol assessed in this study included essential components such as:

- Avoidance of unnecessary tubes and drains
- Early mobilization
- Early enteral nutrition
- Avoidance of routine corticosteroid use
- Preoperative nutritional optimization

Among the **117 patients** included:

- The **ERAS protocol was fully implemented in 47 patients (40.2%)**
- It was **partially implemented** (at least 3 essential components) in **70 patients (59.8%)**

Full implementation was limited by factors such as resource availability (including nutritionists, stoma therapists, and dedicated teams) and administrative barriers, although oncological standards of care were consistently maintained in all cases.

3.3.2. Correlations with Length of Hospital Stay and Postoperative Complications

Statistical analysis revealed significant differences between the two groups (complete vs. partial ERAS implementation):

- **Length of hospitalization:**
 - Average of **4.3 days** in the **full ERAS** group
 - Compared to **6.1 days** in the **partial ERAS** group (**p = 0.01**)

- **Postoperative complications (Fig. 4):**
 - **18.7%** in the **full ERAS** group
 - **34.2%** in the **partial ERAS** group (**p = 0.04**)

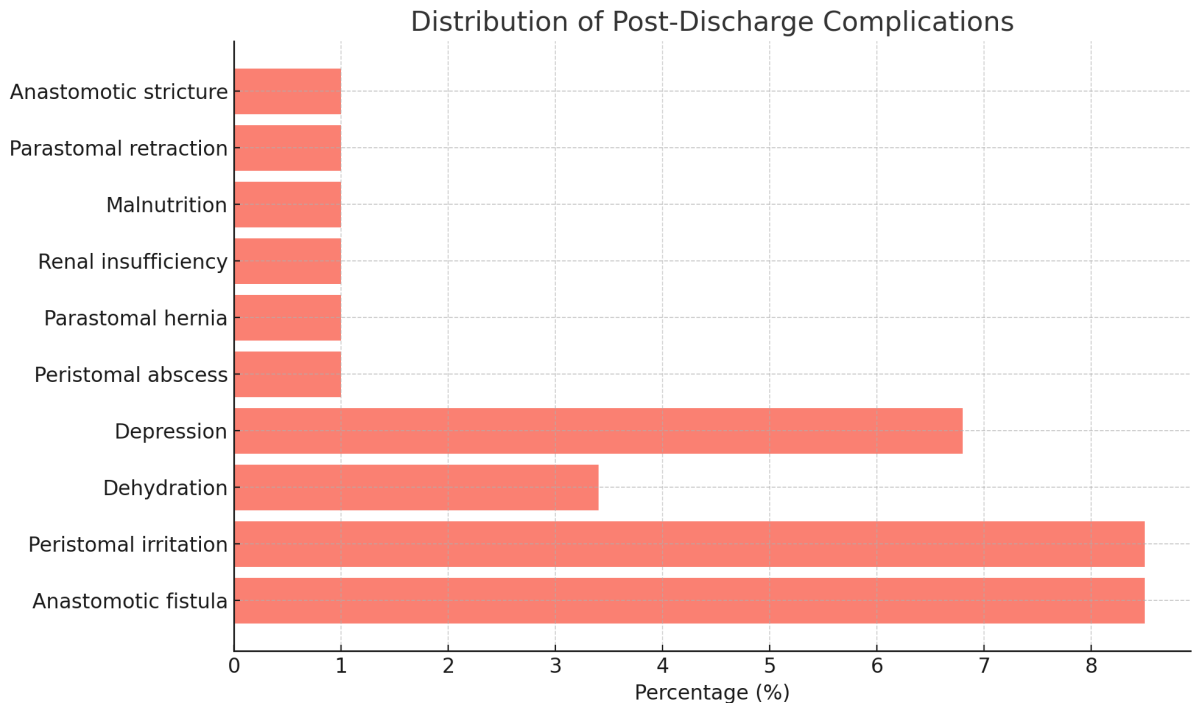


Fig. 4. *Post-discharge complications highlight the need for close follow-up, particularly in patients with temporary ileostomy. The main risk factors include the type of intervention, disease stage, and incomplete application of the ERAS protocol.*

- **Prolonged biological rebalancing (>3 days):**
 - Significantly reduced in the full ERAS group (**p = 0.03**)

In addition, the **rate of ileostomy** was **slightly lower** in the full ERAS group, although it did not reach statistical significance, suggesting a potential trend linked to improved perioperative biological stability.

3.3.3. Observed Benefits and Implementation Challenges

Full application of the ERAS protocol was associated with:

- Reduced early postoperative complications
- Shorter hospitalization

- Faster and more predictable recovery
- Superior biological control during the first postoperative days

However, uniform implementation was hindered by:

- Lack of dedicated personnel (nutritionist, stoma care specialist)
- Difficulties in standardizing preoperative preparation for oncologic patients
- Infrastructure limitations within the hospital system

These challenges underline the **need for a realistic adaptation** of ERAS principles to the national context, as well as their integration into a **surgical decision-making system** that includes the **protective ileostomy indication protocol**.

3.4. Study IV – Development and Validation of a Protocol for Reducing the Need for Routine Ileostomies

3.4.1. Theoretical Foundation

The decision to perform a protective ileostomy in minimally invasive rectal surgery is frequently intuitive, based on the surgeon's experience and intraoperative findings, in the absence of internationally accepted standardized guidelines. Recent studies suggest that a significant number of patients could avoid ileostomy if objective selection criteria were applied.

This thesis aimed to develop a **decision-making protocol based on clinical, oncological, and biological factors**, allowing for the **stratification of anastomotic leakage risk** and the **indication of ileostomy only in justified cases**.

3.4.2. Proposed Objective Scoring System and Risk Criteria

An objective, reproducible, and clinically applicable scoring system was created to stratify the surgical risk, based on:

- **Tumor-related factors** (e.g., location <5 cm from the anal verge, advanced T or N stage)
- **Biological factors** (e.g., preoperative albumin <3.5 g/dL, low total proteins, anemia)
- **Technical factors** (e.g., operative time >300 minutes, complex approaches)

This scoring tool was designed to be easily integrated into clinical practice, facilitating decision-making both **preoperatively and intraoperatively**.

3.4.3. Statistical Validation and Clinical Applicability

The proposed protocol was prospectively implemented in a subgroup of **70 patients** who received the full ERAS protocol, allowing **real-time validation** of the stratified scoring system.

For the remaining **47 patients**, in whom ERAS was not fully applied, the score was calculated **retrospectively** based on documented clinical, biological, and technical data, enabling **objective comparison** and robust evaluation of the protocol's performance across different clinical settings.

Validation findings:

- All patients who developed an **anastomotic leak (n=8)** had a **score ≥ 9** , matching the indication for protective ileostomy
- Among patients with **scores ≤ 4 (n=26)**, none experienced major postoperative complications, and **ileostomy was safely avoided**

Statistical correlations:

- Score significantly correlated with the **need for ileostomy ($p < 0.01$)**
- Also correlated with **length of hospital stay ($p = 0.03$)**
- And with **postoperative electrolyte imbalances ($p < 0.01$)**

Predictive accuracy:

- **AUC (Area Under the Curve): 0.89**, indicating **excellent predictive capacity**

3.4.4. Implementation Proposals

The proposed protocol can be implemented:

- **Preoperatively**, to guide objective surgical planning
- **Intraoperatively**, as an additional tool to support clinical decision-making

Recommendations for practical integration include:

- Incorporation into **local clinical guidelines** for rectal surgery
- Use as a **scoring form** in preoperative patient evaluation
- Integration into **multidisciplinary decision-making** involving surgeons, anesthesiologists, oncologists, and nutritionists
- Future incorporation into **digital decision-support tools**, allowing for **automated and standardized decision-making** on ileostomy indication, reducing inter-surgeon variability and optimizing patient recovery

4. Originality and Personal Contribution of the Thesis

4.1. Innovative Elements and Practical Applicability

This thesis stands out for its **innovative character** and **direct applicability in current surgical practice**, addressing an essential and often overlooked issue: the **rational decision-making** regarding the use of **temporary protective ileostomy** in **minimally invasive rectal surgery**.

Its originality lies in:

- The integration of a **multidimensional analysis** – clinical, biological, and technical – of the factors influencing the decision to perform an ileostomy
- The rigorous correlation between **biological status** and both **operative** and **oncological parameters**
- The assessment of the **ERAS protocol's** impact on **biological equilibrium** and **postoperative recovery**
- The **development and validation** of an **original decision-making protocol**, based on an **objective score** applicable pre- and intraoperatively, which can be used to **standardize surgical decisions**
- The in-depth analysis of **biological and metabolic complications** caused by ileostomy, frequently mentioned in specialized literature

The personal contribution is supported by an extensive study carried out on a **homogeneous cohort**, with all surgeries performed by the **same surgical team**, ensuring **methodological coherence** and **direct clinical relevance**.

4.2. Comparison with the Literature

The current literature offers **contradictory evidence** regarding the benefits of protective ileostomy. Some studies support its preventive use in low anastomoses, while others argue that **associated morbidity may outweigh its benefits**, especially in the absence of rigorous selection.

In contrast, this thesis provides:

- **Concrete, statistically validated data** from real-world surgical practice
- An **integrative approach**, combining oncologic, biological, and technical complexity
- A **practical and reproducible solution**, in the form of a **decision score protocol**

Unlike most retrospective studies focused on describing complications, this work proposes a **transferable decision-making model**, adaptable to any center performing minimally invasive rectal surgery.

4.3. Proposal of an Objective Decision-Making Protocol

The culmination of the thesis is the **development and validation** of an **original scoring system**, which can be applied:

- **Preoperatively**, for personalized surgical planning
- **Intraoperatively**, to adapt to technical difficulty

The proposed protocol is:

- **Evidence-based**, derived from statistically significant correlations
- **Logically stratified**, using tumor-related, biological, and technical factors
- **Simple to apply**, without requiring additional resources or advanced tools
- **Targeted toward reducing routine ileostomies**, without compromising oncological safety

Through this contribution, the thesis brings a **concrete advance** in the **standardization of surgical decisions** in rectal cancer and offers a **validated clinical tool** that can improve **functional outcomes** and **quality of life** for patients.

5. General Conclusions and Clinical Perspectives

5.1. Summary of the Four Studies and Their Integrated Impact

The four studies included in this thesis explored, in a stepwise and integrated manner, the issue of temporary ileostomy in minimally invasive rectal surgery — from patient characterization to the development of a standardized decision-making tool.

- **Study I** emphasized the importance of clinical, biological, and technical factors in the decision to perform an ileostomy, showing that this intervention can be avoided in a significant number of carefully selected patients.
- **Study II** demonstrated the negative impact of ileostomy on postoperative biological balance, highlighting the risks of **hyponatremia, hypokalemia, hypoproteinemia, and anemia**.
- **Study III** analyzed the role of the **ERAS protocol** in optimizing recovery, showing that its complete application correlates with **shorter hospital stays** and a **reduction in complications**.
- **Study IV** integrated all of the above data into a **validated decision-making protocol**, in the form of an **objective clinical score** with high predictive accuracy, enabling **risk stratification** and **rational guidance** of the ileostomy decision.

As a whole, the thesis proposes a **modern, personalized, and scientifically justified** vision of a surgical decision that has a major impact on **postoperative quality of life**.

5.2. Implementation Proposals for Clinical Practice

Based on the results obtained, the following are proposed:

- **Integration of the decision-making protocol into local surgical guidelines** for rectal cancer, in the form of a simple score applicable pre- and intraoperatively
- **Correlation of the score with nutritional assessment** and the implementation of ERAS principles, aiming for a multidimensional optimization of recovery
- **Use of the protocol in multidisciplinary decision-making**, as a communication tool between surgeons, oncologists, anesthesiologists, and nutritionists
- **Inclusion in standardized preoperative documentation**, to support practice uniformity and reduce inter-operator variability

- **Formation of multidisciplinary teams** , including stoma therapists and nutritionists, for the management of patients with ileostomy or at risk for ileostomy

5.3. Future Research Directions and Prospective Validation

This work opens several future research avenues:

- **Prospective multicenter validation** of the proposed protocol, through controlled studies assessing its predictive accuracy across various clinical contexts
- **Expansion of the score** to include radiological and imaging-based predictors (e.g., ICG perfusion assessment)
- **Correlation of the score with long-term functional outcomes**, including the risk of LARS and post-reversal quality of life
- **Development of an integrated digital algorithm**, capable of automating surgical decision-making and supporting personalized medicine in rectal oncology

This thesis introduces, for the first time in Romanian medical literature, a coherent and clinically applicable approach to decision-making regarding protective ileostomy in rectal surgery. The proposed decision-making protocol, although preliminarily validated on a limited cohort within a single-center clinical context, lays a solid foundation for personalizing oncologic treatment and rationalizing the use of surgical resources. This contribution opens relevant perspectives for the development of standardized algorithms in oncologic surgical practice.

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