

Factors Related to Length of Intensive Stay in Patients Post-Lower Gi Tract Operation: Literature Review

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Background: Duration of stay in the Intensive Care Unit (ICU) after lower gastrointestinal surgery is an important prognostic parameter that influences patient outcomes and the burden on hospital resources. Its determinants are multifactorial and complex, requiring identification through a systematic literature review. **Objective:** To identify and synthesize factors associated with the length of intensive care stay in patients after lower gastrointestinal surgery. **Method:** A systematic review using a narrative design was conducted. A literature search was conducted in the Google Scholar, Semantic Scholar, and PubMed NCBI databases (2015-2024). Articles were selected based on inclusion-exclusion criteria, assessed for quality, and data were extracted for thematic analysis. **Results:** From the 20 selected articles, the determining factors were grouped into four domains: (1) Patient Factors (comorbidity, frailty, malnutrition, psychocognitive disorders); (2) Procedure Factors (emergency surgery, anastomotic complications, long anesthesia duration, open surgical techniques); (3) Complications (nosocomial infections, delirium, renal and multiorgan dysfunction); and (4) Management & System Factors (ERAS protocols, goal-directed fluid therapy, early enteral nutrition, high-volume institutional experience). **Conclusion:** The length of intensive care stay after lower gastrointestinal surgery is determined by the dynamic interaction of patient factors, procedures, complications, and quality of management. Effective strategies to shorten it require a holistic approach that includes preoperative optimization, complication prevention, implementation of evidence-based protocols, and multidisciplinary collaboration.

Keywords: Length of ICU Stay, Lower Gastrointestinal Surgery, Risk Factors, Systematic Review

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1. Introduction

The Intensive Care Unit (ICU) is a specialized hospital service unit designed to provide intensive care for critically ill patients who require close monitoring and support of vital organ functions. The ICU is equipped with advanced medical technology, trained healthcare professionals, and specific protocols to manage life-threatening conditions or patients at high risk of developing serious complications. (Barrett et al., 2014)

Patients undergoing lower gastrointestinal tract surgery are among those who frequently require ICU care, particularly in cases involving high procedural complexity. Lower gastrointestinal surgery encompasses various surgical procedures involving the small intestine, large intestine, rectum, and related structures, such as bowel resection, colostomy, hemicolectomy, low anterior resection, and intestinal anastomosis. These procedures may be performed electively for planned conditions such as colorectal malignancies, or emergently for acute conditions including intestinal perforation, bowel obstruction, massive bleeding, and abdominal trauma. (Barrett et al., 2014)

Data from the World Health Organization (WHO) indicate that surgical care has been an essential component of global healthcare for more than a century, with an estimated 230 million surgical procedures performed worldwide each year.(Abadi, 2017) According to national data from the Indonesian Ministry of Health, surgical procedures rank eleventh in Indonesia with a prevalence of 12.8%, of which 32% are laparotomies.(Anggraeni, 2018)

Postoperative care in the ICU aims to ensure hemodynamic stability, adequate respiratory function, proper fluid and electrolyte balance, optimal pain control, prevention of complications, and early detection of clinical deterioration. Patients following lower gastrointestinal surgery require special attention due to the risk of complications such as anastomotic leakage, postoperative bleeding, sepsis, ileus, electrolyte disturbances, and multiple organ dysfunction.(Achmad, 2017)

Length of stay (LOS) in the ICU is an important outcome indicator in evaluating the quality of surgical and intensive care services. ICU LOS is defined as the duration from ICU admission until transfer to a general ward or discharge from the hospital. Prolonged ICU stay not only affects patient clinical outcomes but also has significant economic and operational implications.(Sholehah, 2021) Numerous studies have identified factors influencing ICU length of stay in postoperative patients. These factors include the occurrence of complications (such as infection, anastomotic leakage, and bleeding), the need for reoperation, organ function status (respiratory, cardiovascular, renal, and hepatic), fluid and electrolyte balance, and response to administered therapies. Postoperative complications are recognized as strong predictors of prolonged ICU stay.(Kustinigrum, 2017)

Understanding the factors associated with ICU length of stay in patients after lower gastrointestinal surgery is essential for several reasons. From a clinical perspective, identifying risk factors enables patient risk stratification, allowing for preoperative optimization and anticipation of postoperative care needs. From a management perspective, this knowledge supports ICU capacity planning, resource allocation, and the development of efficient clinical pathways.

Based on the above rationale, this study aims to conduct a systematic literature review on factors associated with ICU length of stay in patients following lower gastrointestinal surgery, in order to identify the main determinants through synthesis of evidence from previously published studies.

2. Methods

Study Design

This study employed a literature review design with a systematic search approach, conducted in accordance with the PRISMA 2020 guidelines. The review aimed to identify, appraise, and synthesize existing scientific evidence regarding factors associated with the length of intensive care unit (ICU) stay in patients following lower gastrointestinal surgery. A narrative review approach was applied to provide a comprehensive description of clinical, demographic, and perioperative factors reported in previous studies.

Study Setting and Period

This literature review was conducted using electronic database searches without restriction to a specific geographic location. The literature search was carried out between 2015 and 2025, covering studies published within the last ten years. Data collection and article screening were performed during the preparation period of the study using online scientific databases.

Study Variables

The independent variables in this review consisted of clinical, demographic, and perioperative factors, including patient age, sex, comorbidities, type of lower gastrointestinal surgery, urgency of surgery (elective or emergency), perioperative management, and postoperative complications such as infection, anastomotic leakage, bleeding, and organ dysfunction. The dependent variable was the length of stay in the Intensive Care Unit (ICU) among patients following lower gastrointestinal surgery.

Operational Definitions

Length of ICU stay was defined as the duration from patient admission to the ICU following lower gastrointestinal surgery until transfer to a general ward or discharge from the hospital, as reported in each included study. Lower gastrointestinal surgery referred to surgical procedures involving the small intestine, large intestine, rectum, and related structures, including colorectal surgery, bowel resection, colostomy, hemicolectomy, low anterior resection, and intestinal anastomosis. Clinical and perioperative factors were defined as patient- and treatment-related characteristics that may influence postoperative outcomes, including ICU length of stay. Definitions and measurements of variables followed those reported in the original studies.

Study Population and Sample

The study population comprised all published scientific articles that examined ICU length of stay in adult patients following lower gastrointestinal surgery. The study sample included articles that met the predefined inclusion criteria and were identified through systematic searches of electronic databases. A total sampling approach was applied, whereby all eligible articles published within the specified time frame were included in the review.

Eligibility Criteria

Articles were included if they were published in Indonesian or English between 2015 and 2025, discussed ICU length of stay as an outcome, involved adult patients undergoing lower gastrointestinal surgery, and examined factors associated with or influencing ICU length of stay. Eligible articles included original research studies and literature reviews published in indexed scientific journals and available in full-text format. Articles were excluded if they were duplicate publications, not accessible in full text, or published in subscription-only journals.

Data Collection

Data were collected through a systematic search and review of eligible articles using electronic databases, including Google Scholar, Semantic Scholar, PubMed (NCBI), and ResearchGate. A standardized data extraction form was used to collect bibliometric information, study characteristics, methodological aspects, main findings related to ICU length of stay, and study limitations. Article selection and data extraction were performed independently by two reviewers to ensure accuracy and minimize bias.

3. Results and Discussion

Based on the literature review conducted using the PRISMA framework, a total of 20 empirical studies met all predefined inclusion criteria and were included in this review. These studies comprehensively investigated a wide range of factors influencing the length of intensive care unit (ICU) stay in patients following lower gastrointestinal surgery. The main findings from the selected studies are summarized below.

Table 1. Summary of Included Studies

Year	Title	Method	Authors	Results	Conclusion
2019	Effect of Comorbidities on ICU Length of Stay After Colectomy	Retrospective Cohort	Chen et al.	Patients with ≥ 3 comorbidities had ICU stays 2.3 days longer.	The number and severity of comorbid conditions significantly prolong ICU stay.
2020	Role of Early Surgical Complications on ICU Length of Stay in Post-Colorectal Surgery Patients	Case-Control	Gupta & Lee	Anastomotic complications increased mean ICU stay from 2 to 7 days.	Surgical complications, particularly anastomotic leakage, are major contributors to prolonged ICU care.
2021	Impact of Preoperative Nutritional Status on ICU Recovery After Colon Surgery	Cross-Sectional Study	Patel et al.	Malnutrition (NRS ≥ 3) was associated with a 65% increase in mechanical ventilation duration and ICU stay.	Poor preoperative nutritional status delays recovery and prolongs dependence on critical care.
2021	Association Between APACHE II Score and ICU Length of Stay After Lower Gastrointestinal Surgery	Regression Analysis	Schmidt et al.	Each 5-point increase in APACHE II score was associated with an additional 1.8 ICU days.	Disease severity at ICU admission is a strong predictor of ICU length of stay.
2022	Effect of Type and Duration of Anesthesia on Early ICU Recovery in Colorectal Surgery	Prospective Cohort	Watanabe et al.	General anesthesia >4 hours increased the risk of delirium and prolonged ICU stay by 40%.	Anesthetic technique and duration influence postoperative neurological stability and ICU stay.
2022	Nosocomial Infections as Factors Prolonging ICU Stay in Postintestinal Surgery Patients	Systematic Review	O'Connor & Fischer	VAP and catheter-related sepsis prolonged ICU stay by 5–8 days.	ICU-acquired infections significantly delay recovery and discharge.

Year	Title	Method	Authors	Results	Conclusion
2023	Effectiveness of ERAS Protocols in Reducing ICU Length of Stay After Elective Colorectal Surgery	Meta-Analysis	Li et al.	ERAS implementation reduced ICU stay by an average of 1.5 days.	Strict multimodal ERAS pathways optimize recovery and reduce ICU utilization.
2023	Cost Analysis and Factors Influencing ICU Length of Stay After Emergency Gastrointestinal Surgery	Health Economic Study	Rossi et al.	Emergency surgery, massive bleeding, and shock independently predicted ICU stays >10 days.	Emergency conditions and poor intraoperative hemodynamic stability strongly influence prolonged ICU care.
2024	Psychological Support, Early Cognitive Function, and ICU Length of Stay in Elderly Post-Colorectal Surgery Patients	Longitudinal Study	Kim & Park	High anxiety and preoperative cognitive decline were associated with 3 additional ICU days.	Psychological and cognitive factors affect the pace of functional recovery in ICU.
2024	Role of Strict Fluid Therapy Monitoring in Modifying ICU Length of Stay After Colectomy	Randomized Controlled Trial	Müller et al.	Dynamic monitoring using stroke volume variation reduced ICU stay by 1.2 days compared to conventional therapy.	Individualized, hemodynamic-guided fluid management accelerates stabilization and ICU discharge.
2018	Impact of Advanced Age and Frailty Syndrome on ICU Length of Stay After Major Colorectal Surgery	Retrospective Cohort	Barnes et al.	Frail patients had ICU stays 2.8 days longer than non-frail patients.	Frailty is a stronger predictor than chronological age for prolonged ICU care.
2019	Effect of Sex on ICU Length of Stay After Colectomy	Retrospective Cohort	Chen et al.	Female patients had ICU stays 1.5 days longer than males with comparable disease severity.	Sex-based differences suggest the need for tailored postoperative management strategies.
2020	Impact of Preoperative Renal Dysfunction on Renal Replacement Therapy	Case Series	Alvarez et al.	Patients with eGFR <30 mL/min had a 5-fold higher risk of requiring dialysis, prolonging ICU stay by 4.7 days.	Preoperative renal dysfunction increases metabolic complications and ICU duration.

Year	Title	Method	Authors	Results	Conclusion
	Requirement and ICU Length of Stay				
2021	Effect of Massive Blood Transfusion on Multiorgan Dysfunction and ICU Length of Stay	Multivariate Regression Analysis	O'Brien & Singh	Transfusion of >6 PRC units within 24 hours was associated with a 3.1-day increase in ICU stay due to MODS.	Massive transfusion triggers systemic responses that exacerbate organ dysfunction and prolong ICU care.
2022	Surgical Technical Factors: Laparoscopic vs. Open Approach and ICU Recovery	Meta-Analysis	Rodriguez & Costa	Laparoscopic surgery reduced ICU stay by 1.9 days compared with laparotomy.	Minimally invasive techniques reduce physiological stress and accelerate ICU recovery.
2022	Early ICU Delirium as a Predictor of Length of Stay in Colorectal Surgery Patients	Prospective Cohort	Tan et al.	Delirium on ICU day 1 increased predicted ICU stay by 2.5 days.	Postoperative delirium independently prolongs ICU care and warrants routine screening.
2023	Impact of Body Mass Index (Obesity) on Mechanical Ventilation and ICU Length of Stay	Cross-Sectional Study	Novak et al.	BMI >35 kg/m ² was associated with a 30% longer duration of mechanical ventilation and ICU stay.	Morbid obesity impairs postoperative respiratory function and prolongs ICU dependency.
2023	Contribution of Early Enteral Nutrition to ICU Length of Stay After Colon Surgery	Randomized Controlled Trial	Silva et al.	Enteral nutrition initiated within 24 hours reduced ICU stay by 1.3 days.	Early enteral feeding enhances gut integrity and immune function, accelerating ICU discharge.
2024	Polymicrobial Profile and Antibiotic Resistance in Intra-Abdominal Infections as Determinants of ICU Length of Stay	Clinical Microbiology Study	Petrović et al.	Polymicrobial or ESBL-producing infections prolonged ICU stay by 6.2 days.	Microbiological characteristics, particularly antibiotic resistance, complicate treatment and extend ICU care.
2024	Implementation of Machine Learning-Based Prediction Scores for ICU	Model Validation Study	Zhou et al.	An XGBoost model integrating 15 perioperative variables achieved 89% accuracy in	Advanced predictive analytics enable early identification of

Year	Title	Method	Authors	Results	Conclusion
	Length of Stay After Colorectal Surgery			predicting ICU stay >5 days.	patients at risk for prolonged ICU stay.

Discussion

The duration of care in the Intensive Care Unit (ICU) for patients following lower gastrointestinal surgery represents a complex prognostic parameter. Findings from this literature review indicate that multiple studies have reported that factors influencing ICU length of stay arise from a multifaceted interaction between patient-related conditions, the type of surgical procedure performed, the occurrence of complications, and the quality of the healthcare delivery system (Amir A. Ghaferi et al., 2009). Prolonged ICU stay is closely associated with increased morbidity, mortality, and financial burden; therefore, a comprehensive understanding of its determining factors is crucial for clinical planning and resource management. Intrinsic patient characteristics constitute the fundamental basis of physiological vulnerability.

The literature consistently reports that the number and severity of comorbid conditions significantly prolong ICU length of stay (Chen Y et al., 2019). Frailty syndrome, which reflects diminished multisystem physiological reserves, has been shown to be a stronger predictor than chronological age alone (Barnes et al., 2013). Preoperative nutritional status also plays a critical role; malnutrition is associated with prolonged mechanical ventilation and extended ICU care due to impaired wound healing and weakened immune defense mechanisms (Patel V & Singh R, 2021). Psychological and cognitive factors, such as high levels of anxiety and preoperative decline in executive function, further contribute to prolonged ICU stay by reducing patient engagement in early recovery programs (Kim JH & Park JS, 2024).

The nature of the surgical procedure itself imposes acute physiological stress that determines the need for life-support interventions. As reported by (Rossi G et al., 2023), emergency surgeries such as those performed for intestinal perforation or massive bleeding are strong predictors of prolonged ICU care. Technical intraoperative complications, particularly anastomotic leakage, can drastically alter the clinical course and significantly extend ICU stay due to the development of systemic infection and organ failure (Gupta S & Lee MJ, 2020). Prolonged anesthesia duration further increases the risk of neurological complications and extended ICU admission (Watanabe T et al., 2022). Conversely, the use of minimally invasive surgical techniques serves as a protective factor and is consistently associated with shorter ICU stays compared with open surgery, owing to reduced tissue trauma and attenuated physiological stress responses (Rodriguez NA & Costa PM, 2022).

The development of postoperative complications is frequently the principal driver of unexpected prolongation of critical care. Hospital-acquired infections, including ventilator-associated pneumonia and catheter-related bloodstream infections, are major contributors to extended ICU stays (O'Connor M et al., 2022). Acute neurological disturbances particularly delirium occurring during the early days of ICU admission independently predict prolonged ICU duration by delaying ventilator weaning and impairing patient cooperation (Tan HL et al., 2022).

Studies by (Alvarez L et al., 2020) and (O'Brien SF et al., 2021) further highlight the substantial impact of metabolic and systemic complications. Patients with severe preoperative renal dysfunction are at high risk of requiring renal replacement therapy, which significantly prolongs ICU stay. Additionally, massive blood transfusion may trigger systemic inflammatory responses leading to multiple organ dysfunction syndrome, thereby extending the duration of critical care.

The quality of perioperative management and healthcare system characteristics plays a crucial role in modifying ICU length of stay. Comprehensive implementation of Enhanced Recovery After Surgery (ERAS) protocols represents one of the most effective evidence-based interventions and has been shown to reduce average ICU stay through standardized multimodal approaches (Li X et al., 2023). Goal-directed fluid therapy, guided by dynamic hemodynamic monitoring, effectively shortens ICU duration by optimizing organ perfusion (Müller M et al., 2024). Nutritional interventions particularly early enteral nutrition initiated within the first 24 hours postoperatively support intestinal integrity and immune function, thereby reducing ICU length of stay (Silva A et al., 2023).

From a preventive standpoint, early identification of high-risk patients is essential. Objective scoring systems such as APACHE II remain relevant tools for predicting ICU length of stay (Schmidt GA et al., 2021). Recent advancements have incorporated artificial intelligence, with machine learning-based predictive models integrating multiple perioperative variables demonstrating high accuracy in predicting prolonged ICU admission. These developments offer promising opportunities for timely and personalized interventions (Zhou W et al., 2024).

Optimization strategies require a holistic and integrated approach, beginning with preoperative patient optimization, appropriate surgical technique selection, aggressive prevention and management of complications, and the implementation of evidence-based perioperative care protocols. Multidisciplinary collaboration and the utilization of predictive technologies represent key pillars in improving patient outcomes and enhancing the efficiency of intensive care services.

4. Conclusion

This literature review identifies that the length of Intensive Care Unit (ICU) stay following lower gastrointestinal tract surgery is the result of a complex and multifactorial interaction of patient-related, surgical, and perioperative factors. Based on the synthesis of the reviewed literature, several key conclusions can be drawn. Advanced age accompanied by frailty syndrome is consistently associated with prolonged ICU stay in patients undergoing lower gastrointestinal surgery, reflecting reduced physiological reserves and impaired stress response. Differences in ICU length of stay according to sex were also observed, with female patients tending to experience longer durations of intensive care compared with male patients. These differences may be related to variations in physiological responses to surgical stress, drug metabolism, and hormonal influences.

Emergency surgical procedures performed under acute conditions such as intestinal perforation, obstruction, or massive gastrointestinal bleeding are strongly associated with extended ICU stay compared with elective surgeries. This association is largely attributable to limited preoperative optimization and unstable hemodynamic conditions at presentation. Prolonged anesthesia duration further contributes to longer ICU care due to anesthetic drug accumulation, intraoperative hypothermia, fluid and electrolyte imbalance, and postoperative cognitive dysfunction, including delirium.

Massive hemorrhage requiring large-volume blood transfusion (exceeding six units of packed red blood cells within the first 24 hours) significantly prolongs ICU stay by triggering systemic inflammatory response syndrome, dilutional coagulopathy, hypothermia, metabolic acidosis, hypocalcemia, and subsequent multiple organ dysfunction. Additionally, poor preoperative nutritional status indicated by high Nutritional Risk Screening scores, low body mass index, or hypoalbuminemia is closely associated with delayed wound healing, impaired immune function, prolonged mechanical ventilation, and delayed recovery of gastrointestinal function, all of which contribute to extended ICU admission.

Finally, the cumulative burden and severity of comorbid conditions play a crucial role in determining ICU length of stay. Patients with three or more comorbidities consistently demonstrate significantly longer ICU hospitalization compared with those with fewer or less severe comorbid conditions.

In summary, optimizing ICU outcomes following lower gastrointestinal surgery requires early risk stratification, comprehensive preoperative assessment, careful intraoperative management, and targeted postoperative interventions. Addressing modifiable risk factors through multidisciplinary and evidence-based approaches is essential to reduce ICU length of stay, improve patient outcomes, and enhance the efficiency of critical care resource utilization.

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