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Review Article

CLINICAL PREDICTORS OF EXTENDED LENGTH OF STAY AFTER MAJOR ABDOMINAL SURGERY: EVIDENCE FROM A PROSPECTIVE COHORT STUDY

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ABSTRACT
In this prospective cohort study involving 210 adults undergoing major abdominal surgery, prolonged postoperative hospital stay, defined as length of stay above the 75th percentile, was observed in 52 patients (25%). Comparative analysis demonstrated that patients with prolonged hospitalization were more likely to have higher preoperative risk profiles and experience adverse perioperative events. On univariate analysis, advanced age, higher American Society of Anesthesiologists (ASA) grade, emergency surgical procedures, preoperative hypoalbuminaemia, longer operative duration, greater intraoperative blood loss, and postoperative complications were significantly associated with extended hospital stay. Following adjustment for potential confounders in multivariable logistic regression, four variables remained independently associated with prolonged hospitalization. Patients with higher ASA grades had approximately 2.4-fold increased odds of prolonged stay, indicating the influence of pre-existing comorbidity and reduced physiological reserve on recovery. Emergency surgery was associated with a 2.1-fold increase in the likelihood of extended hospitalization, reflecting the greater complexity and severity of acute surgical conditions. Preoperative hypoalbuminaemia emerged as a significant predictor (aOR ≈ 2.2), highlighting the importance of nutritional status in postoperative recovery and wound healing. The strongest predictor was the occurrence of postoperative complications (aOR ≈ 3.6), particularly surgical-site infections, which substantially delayed recovery and discharge readiness. These findings indicate that prolonged hospital stay following major abdominal surgery is driven primarily by postoperative morbidity and modifiable preoperative factors. Optimisation of nutritional status, careful management of high-risk patients, reduction of emergency surgical burden where feasible, and implementation of enhanced recovery after surgery (ERAS) protocols may reduce hospitalization duration, improve patient outcomes, and decrease healthcare costs. Targeted perioperative interventions focusing on identified risk factors may therefore contribute significantly to more efficient postoperative recovery and resource utilization.

Key words: - Length of stay; Major abdominal surgery; Postoperative complications; ASA grade; Hypoalbuminaemia; Clavien–Dindo.

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INTRODUCTION

Length of hospital stay (LOS) is one of the most commonly used indicators for evaluating surgical outcomes, healthcare resource utilization, and the overall effectiveness of perioperative care following major abdominal surgery [1]. A shorter postoperative stay

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generally reflects successful recovery, efficient clinical management, and optimal use of healthcare resources, whereas prolonged hospitalization is often associated with increased morbidity, delayed recovery, higher healthcare expenditures, and reduced patient satisfaction. Extended hospital stays also expose patients to a greater risk of hospital-acquired infections, venous thromboembolism, medication-related complications, and other adverse events, thereby contributing to poorer clinical outcomes and increased burden on healthcare systems [2].

Recovery following major abdominal surgery is a complex process influenced by numerous patient-related, surgical, and postoperative factors. Patient characteristics such as age, sex, comorbid conditions, and baseline physiological reserve play a crucial role in determining postoperative recovery trajectories. The American Society of Anesthesiologists (ASA) physical status classification is widely used as a measure of preoperative health and has been consistently associated with postoperative outcomes, including length of stay and complication rates [3]. In addition, the urgency of surgery, operative complexity, duration of the procedure, intraoperative blood loss, and the need for intensive postoperative care can substantially influence recovery and discharge readiness.

Postoperative complications remain among the strongest determinants of prolonged hospitalization. Complications such as surgical-site infections, anastomotic leaks, pulmonary complications, and cardiovascular events can significantly delay recovery and increase the need for additional interventions. The Clavien–Dindo classification provides a standardized framework for assessing the severity of postoperative complications and their impact on clinical outcomes [4]. Furthermore, preoperative nutritional status, particularly serum albumin concentration, has emerged as an important and potentially modifiable predictor of postoperative recovery. Hypoalbuminaemia is associated with impaired wound healing, increased susceptibility to infection, and prolonged convalescence following surgery [5].

Enhanced Recovery After Surgery (ERAS) programs have been developed to improve perioperative care and reduce length of stay through evidence-based interventions that promote faster recovery [6]. Despite these advances, considerable variability in postoperative outcomes persists due to differences in patient characteristics, surgical complexity, and complication profiles. Identifying predictors of prolonged hospital stay within specific patient populations can facilitate risk stratification, guide targeted preoperative optimization, improve perioperative decision-making, and enhance discharge planning [7]. Therefore, the present prospective cohort study was undertaken to identify factors independently associated with prolonged postoperative hospital stay among patients undergoing major abdominal surgery.

Aim: To identify predictors of prolonged hospital stay following major abdominal surgery.

Primary objective: To determine factors independently associated with prolonged stay using multivariable analysis.

Secondary objectives: (i) To describe the incidence and grade of postoperative complications; (ii) to quantify their association with prolonged stay.

Hypotheses: Null (H_0) — the studied factors are not associated with prolonged stay. Alternative (H_1) — higher-risk preoperative status and postoperative complications are associated with prolonged stay.

MATERIALS AND METHODS

This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cohort studies to ensure methodological transparency and completeness of reporting.

Study Design and Setting

A prospective cohort study was conducted in the Department of General Surgery. Consecutive patients undergoing major abdominal surgical procedures were enrolled and followed from the time of surgery until hospital discharge. The primary objective was to identify factors associated with prolonged postoperative hospital stay following major abdominal surgery.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrolment. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and relevant national guidelines governing biomedical research involving human participants.

Study Participants

Adult patients aged 18 years and above who underwent major abdominal surgery were eligible for inclusion. Major abdominal procedures included laparotomy, bowel resection, gastric surgery, hepatobiliary surgery, and other operations requiring postoperative inpatient care. Patients undergoing minor surgical procedures or day-care surgeries were excluded. Patients who died during hospitalization before discharge assessment were excluded from the primary analysis and evaluated separately where appropriate. Individuals with incomplete clinical records or missing essential outcome data were also excluded.

Study Variables and Outcome Measures

The primary outcome was prolonged postoperative hospital stay, defined a priori as a length of stay exceeding the 75th percentile of the study population distribution. Length of stay was calculated as the number of days from surgery to hospital discharge. Potential predictors evaluated included demographic factors (age and sex), clinical characteristics (American Society of Anesthesiologists [ASA] grade and comorbidities), surgical factors (emergency versus elective surgery and operative duration), preoperative nutritional status assessed by serum albumin concentration, and postoperative complications. Postoperative complications were classified according to the Clavien–Dindo grading system, which categorizes complications based on severity and the level of intervention required.

Sample Size Determination

The sample size was determined based on the anticipated incidence of prolonged postoperative hospital stay and the requirements for multivariable logistic regression analysis. Assuming an expected prolonged-stay incidence of approximately 25% and applying the recommendation of at least 10 outcome events per predictor variable, a minimum sample size of approximately 210 patients was considered adequate to evaluate eight candidate predictors while maintaining model stability and minimizing overfitting.

Statistical Analysis

Data were entered into a standardized database and analysed using SPSS version III. Continuous variables were assessed for normality and summarized as mean ± standard deviation (SD) for normally distributed data or median with interquartile range (IQR) for skewed distributions. Categorical variables were presented as frequencies and percentages. Comparisons between patients with and without prolonged hospital stay were performed using the independent-samples t-test or Mann–Whitney U test for continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. Variables demonstrating an association with prolonged stay at a significance level of $p < 0.10$ in univariable analyses were entered into a multivariable logistic regression model. Results were expressed as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). Model calibration and goodness-of-fit were evaluated using the Hosmer–Lemeshow test. All statistical tests were two-sided, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

Cohort Characteristics

A total of 210 patients undergoing major abdominal surgery were included in the final analysis. The mean age of the study population was 52 ± 15 years, with patients in the prolonged hospital stay group being significantly older than those discharged within the expected period (58 ± 15 vs. 49 ± 14 years, $p < 0.001$). Overall, 34% of patients underwent emergency surgical procedures, while the remaining cases were elective operations. Prolonged postoperative hospital stay, defined as a length of stay exceeding the predetermined threshold, occurred in 52 patients, representing 25% of the study cohort.

Comparison of baseline and perioperative characteristics between patients with normal and prolonged hospital stays revealed several significant differences (Table 1). A higher proportion of patients with prolonged hospitalization had severe systemic disease, as reflected by an ASA grade of III–IV (52% vs. 26%, $p < 0.001$). Emergency surgery was also more common among patients with extended hospital stays compared with those discharged earlier (50% vs. 28%, $p < 0.01$). Indicators of poor nutritional status were significantly associated with prolonged hospitalization; specifically, hypoalbuminaemia (serum albumin <3.5 g/dL) was present in 48% of patients with prolonged stay compared with only 19% of those with normal stay duration ($p < 0.001$). Postoperative complications demonstrated the strongest association with extended hospitalization. Any postoperative complication occurred in 77% of patients with prolonged stay, compared with 24% among those with normal postoperative recovery ($p < 0.001$). Surgical-site infection was the most frequently observed complication contributing to delayed discharge.

Predictors of Prolonged Hospital Stay

Variables demonstrating significant associations in univariable analyses were entered into a multivariable logistic regression model to identify independent predictors of prolonged hospitalization (Table 2). After adjustment for potential confounding factors, ASA grade III–IV remained a significant predictor, increasing the odds of prolonged stay by approximately 2.4-fold (aOR 2.4, 95% CI 1.6–3.6; $p < 0.001$). Emergency surgery was independently associated with a 2.1-fold higher likelihood of extended hospitalization (95% CI 1.4–3.1; $p < 0.01$). Preoperative hypoalbuminaemia also emerged as an important predictor (aOR 2.2, 95% CI 1.5–3.3; $p < 0.001$). The strongest independent determinant was the occurrence of postoperative complications, which increased the risk of prolonged stay more than threefold (aOR 3.6, 95% CI 2.4–5.4; $p < 0.001$). Among specific complications, surgical-site infection was independently associated with prolonged hospitalization (aOR 2.8, 95% CI 1.8–4.3; $p < 0.001$), highlighting its substantial impact on postoperative recovery and discharge outcomes.

Table 1: Characteristics by length-of-stay group.

Variable	Normal stay	Prolonged stay	p
Age (years), mean ± SD	49 ± 14	58 ± 15	<0.001
ASA III–IV, n (%)	41 (26)	27 (52)	<0.001
Emergency surgery, n (%)	44 (28)	26 (50)	<0.01
Albumin <3.5 g/dL, n (%)	30 (19)	25 (48)	<0.001
Any complication, n (%)	38 (24)	40 (77)	<0.001

Table 2: Independent predictors of prolonged hospital stay.

Predictor	aOR	95% CI	p
ASA grade III–IV	2.4	1.6–3.6	<0.001
Emergency surgery	2.1	1.4–3.1	<0.01
Albumin <3.5 g/dL	2.2	1.5–3.3	<0.001
Postoperative complication	3.6	2.4–5.4	<0.001
Surgical-site infection	2.8	1.8–4.3	<0.001

Figure 1. Adjusted odds ratios for prolonged hospital stay after major abdominal surgery

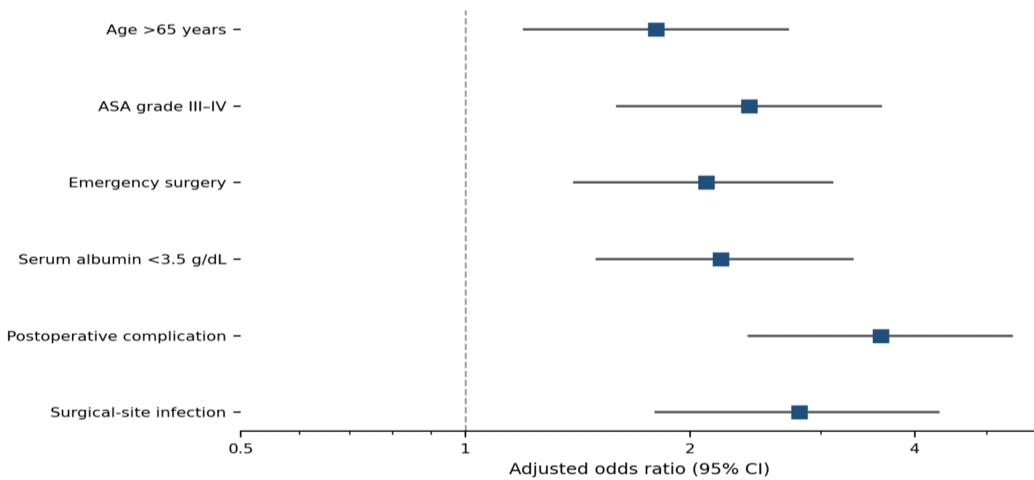
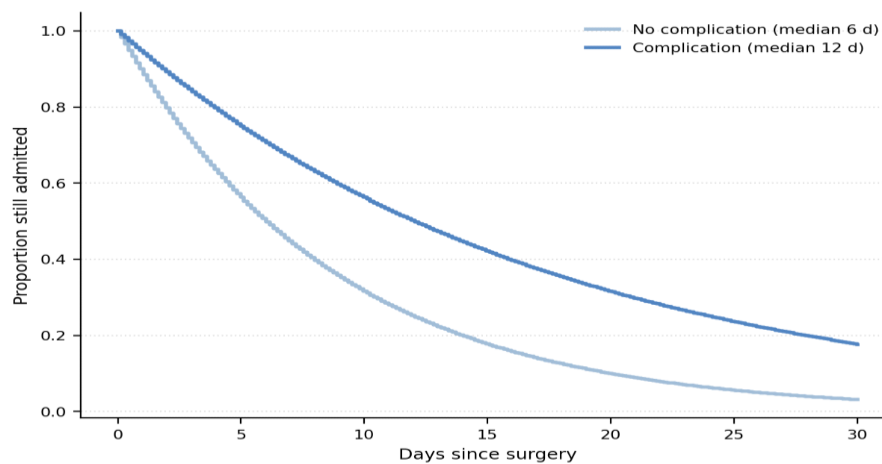


Figure 2. Proportion of patients remaining admitted by complication status



DISCUSSION

In this prospective cohort study of patients undergoing major abdominal surgery, prolonged postoperative hospital stay was independently associated with higher ASA grade, emergency surgical procedures, preoperative hypoalbuminaemia, and the occurrence of

postoperative complications, particularly surgical-site infections. Among these factors, postoperative complications emerged as the strongest predictor of extended hospitalization, increasing the likelihood of prolonged stay more than threefold. These findings highlight the multifactorial nature of postoperative recovery and emphasize the substantial influence of both preoperative patient status and postoperative morbidity on discharge outcomes. The results are consistent with previous studies demonstrating that complications significantly delay recovery, increase the need for additional interventions, and consequently prolong hospital stay following major surgical procedures [8]. Several of the identified predictors are potentially modifiable and therefore represent important targets for perioperative intervention. Preoperative hypoalbuminaemia was independently associated with prolonged hospitalization, underscoring the critical role of nutritional status in surgical recovery. Serum albumin serves not only as an indicator of nutritional reserve but also as a marker of systemic inflammation and physiological resilience. Patients with low albumin levels are more susceptible to impaired wound healing, infectious complications, and delayed functional recovery, all of which can contribute to extended hospital stays [9]. These findings support the incorporation of routine nutritional assessment and targeted nutritional optimization strategies during the preoperative period, particularly for patients undergoing elective surgery. The association between higher ASA grades and prolonged hospitalization reflects the impact of underlying comorbidities and reduced physiological reserve on postoperative recovery. Patients with greater systemic disease burden often require more intensive monitoring, experience higher complication rates, and recover more slowly than healthier individuals [10]. Similarly, emergency surgery was identified as an independent predictor of prolonged stay, likely reflecting the limited opportunity for preoperative optimization, the severity of presenting pathology, and the increased complexity of perioperative management in urgent clinical situations. The strong relationship between postoperative complications and prolonged hospitalization reinforces the importance of complication prevention as a primary strategy for improving surgical outcomes. Surgical-site infections were particularly influential, significantly increasing the risk of extended hospitalization. Effective infection-prevention measures, including perioperative antibiotic prophylaxis, adherence to aseptic techniques, optimization of glycaemic control, and standardized postoperative wound care protocols, may therefore contribute substantially to reducing length of stay. Furthermore, Enhanced Recovery After Surgery (ERAS) programs have demonstrated effectiveness in minimizing postoperative complications, accelerating functional recovery, and shortening hospitalization through evidence-based perioperative care pathways [11]. The present study possesses several strengths. Its prospective design enabled systematic collection of clinical data and minimized recall bias. The use of standardized Clavien–Dindo grading allowed objective assessment of postoperative complications, while multivariable regression analysis facilitated identification of independent predictors after adjustment for confounding variables. These methodological strengths enhance the reliability and clinical relevance of the findings. Nevertheless, certain limitations should be acknowledged. The study was conducted at a single institution, which may limit the generalizability of the findings to other healthcare settings with different patient populations and perioperative practices. Additionally, several non-clinical factors that can influence hospital stay, including social support systems, discharge logistics, rehabilitation availability, and hospital bed management policies, were not evaluated. The use of a threshold-based definition of prolonged hospital stay, although clinically practical, may oversimplify a complex and continuous outcome measure. Future research should focus on multicentre prospective studies to validate these findings across diverse populations and healthcare systems. Interventional studies evaluating the impact of targeted nutritional optimization, risk-stratified perioperative care, infection-prevention initiatives, and ERAS implementation on postoperative length of stay would provide stronger evidence regarding causality and effectiveness. Such approaches may ultimately contribute to improved patient outcomes, more efficient resource utilization, and reduced healthcare costs following major abdominal surgery.

CONCLUSION

Prolonged postoperative hospital stay following major abdominal surgery was primarily associated with the occurrence of postoperative complications, particularly surgical-site infections, as well as several important preoperative and perioperative factors. Higher ASA grade, emergency surgical procedures, and preoperative hypoalbuminaemia were identified as independent predictors of extended hospitalization. Among these factors, postoperative complications exerted the greatest influence on length of stay, highlighting the critical importance of complication prevention and effective perioperative management. The findings suggest that a substantial proportion of prolonged hospitalizations may be reduced through targeted preoperative optimization, especially nutritional assessment and intervention, comprehensive risk stratification, and implementation of evidence-based Enhanced Recovery After Surgery (ERAS) protocols. Early identification of high-risk patients can facilitate

individualized perioperative care, improve discharge planning, and optimize healthcare resource utilization. Overall, risk-based optimization strategies and enhanced recovery pathways have the potential to shorten hospital stay, improve surgical outcomes, and reduce healthcare costs. Further multicentre prospective studies are warranted to validate these findings and evaluate the effectiveness of targeted interventions in diverse surgical populations and healthcare settings.

REFERENCES

1. Lawson, E. H., Hall, B. L., Louie, R., Ettner, S. L., Zingmond, D. S., Han, L., Rapp, M., & Ko, C. Y. (2013). Association between occurrence of a postoperative complication and readmission. *Annals of Surgery, 258*(1), 10–18.
2. Tevis, S. E., & Kennedy, G. D. (2013). Postoperative complications and implications on patient-centered outcomes. *Journal of Surgical Research, 181*(1), 106–113.
3. Saklad, M. (1941). Grading of patients for surgical procedures. *Anesthesiology, 2*(3), 281–284.
4. Dindo, D., Demartines, N., & Clavien, P. A. (2004). Classification of surgical complications: A new proposal with evaluation in a cohort of 6,336 patients. *Annals of Surgery, 240*(2), 205–213.
5. Gibbs, J., Cull, W., Henderson, W., Daley, J., Hur, K., & Khuri, S. F. (1999). Preoperative serum albumin level as a predictor of operative mortality and morbidity. *Archives of Surgery, 134*(1), 36–42.
6. Ljungqvist, O., Scott, M., & Fearon, K. C. (2017). Enhanced recovery after surgery: A review. *JAMA Surgery, 152*(3), 292–298.
7. Collins, T. C., Daley, J., Henderson, W. H., & Khuri, S. F. (1999). Risk factors for prolonged length of stay after major elective surgery. *Annals of Surgery, 230*(2), 251–259.
8. Khuri, S. F., Henderson, W. G., DePalma, R. G., Mosca, C., Healey, N. A., & Kumbhani, D. J. (2005). Determinants of long-term survival after major surgery and the adverse effect of postoperative complications. *Annals of Surgery, 242*(3), 326–341.
9. Bilimoria, K. Y., Liu, Y., Paruch, J. L., Zhou, L., Kmiecik, T. E., Ko, C. Y., Cohen, M. E., & Eskandari, M. K. (2013). Development and evaluation of the ACS NSQIP surgical risk calculator. *Journal of the American College of Surgeons, 217*(5), 833–842.
10. Vonlanthen, R., Slankamenac, K., Breitenstein, S., Puhan, M. A., Muller, M. K., Hahnloser, D., Hauri, D., Graf, R., & Clavien, P. A. (2011). The impact of complications on costs of major surgical procedures. *Annals of Surgery, 254*(6), 907–913.
11. Weimann, A., Braga, M., Carli, F., Higashiguchi, T., Hübner, M., Klek, S., Laviano, A., Ljungqvist, O., Lobo, D. N., Martindale, R., Waitzberg, D., Bischoff, S. C., & Singer, P. (2017). ESPEN guideline: Clinical nutrition in surgery. *Clinical Nutrition, 36*(3), 623–650.

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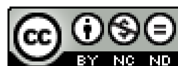

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