Volume 11, Issue 3, March – 2026 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26mar1539

Determinants of Postoperative Morbidity and Mortality: Clinical, Surgical, and Socio-Systemic Influences on Surgical Outcomes

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Publication Date: 2026/03/30

Abstract: Morbidity and mortality after surgery are still an important measure of quality of surgical practice and patient safety across the globe. Although the perioperative care has improved significantly, a high percentage of surgical patients have complications, which impact negatively on long- and short-term survival. These are the results of a complicated combination of patient-specific factors, the nature of the procedure, perioperative care, and social determinants of health in general. The article is a narrative review that summarizes the traditional and modern evidence on postoperative morbidity and mortality determinants in surgical specialties, especially among older adults, high-risk procedures, emergency surgery, and systemic susceptibility. Besides, illustrative analyses with 85 primary cohort of surgical patients are also provided to show the relative contribution of clinical risk factors, biochemical risk factors and social risk factors. The results support the notion that the postoperative outcomes are not purely dependent on the procedures, but cumulative biological, psychosocial, and health-system factors, which contributes to the importance of the integrated, risk-stratified approaches to perioperative.

Keywords: *Postoperative Complications; Surgical Mortality; Risk Factors; Perioperative Care; Social Determinants of Health; Surgical Outcomes.*

How to Cite: Dr. Rajib Kumar Majumdar; Prashant Saraswat; Shadaab Malik (2026) Determinants of Postoperative Morbidity and Mortality: Clinical, Surgical, and Socio-Systemic Influences on Surgical Outcomes. *International Journal of Innovative Science and Research Technology*, 11(3), 2608-2613. https://doi.org/10.38124/ijisrt/26mar1539

I. INTRODUCTION

Postoperative morbidity and mortality are considered the most abnormal measures of surgical performance and healthcare quality. The initial studies on surgical outcomes themselves were dominated by the mortality rates of a specific procedure, especially in cardiothoracic and major oncologic surgery (Teoh et al., 1987; Wahi et al., 1989). It was realized in the long run mortality is not a sufficient measure of the burden of postoperative harm, since non-fatal morbidity has a profound effect on the long-term survival, functional recovery and the use of healthcare (Ferraris and Ferraris 1996; Khuri et al. 2005). Huge observational and registry-based experiments show that postoperative complications are closely linked with decreased survival in the long term, although early mortality is prevented (Moonesinghe et al., 2014; Khuri et al., 2005). In turn, the modern research in perioperative focuses on the program of determining the factors of morbidity and mortality within the whole surgical course that could be adjusted. The latest findings also underline the role of social determinants of health, nutritional status, mental health, and access to healthcare as the factors contributing to the postoperative outcomes especially in low- and middle-income conditions (Tsehay et al., 2024; Sullivan et al., 2024). This wider viewpoint makes the surgical risk assessment consistent with the researches in the field of public health and health-systems.

II. PATIENT-RELATED DETERMINANTS

➢ *Age, Frailty, and Comorbidity*

Old age is also always linked to postoperative morbidity and mortality especially after cardiac, thoracic, and orthopedic operations (Rady et al., 1998; Deiwick et al., 1997; 5). Nonetheless, chronological age is not a perfect predictor, physiological reserve, frailty, and comorbidity burden have a greater influence on the outcomes. In geriatric patients who

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26mar1539

have cardiovascular diseases, kidney impairments, and are unable to move around, it is proved that cardiovascular disease, kidney dysfunctions and immobility significantly contribute to the risk of postoperative mortality (Mariconda et al., 2015; Åhman et al., 2018). The same trends are also seen in the case of mitral valve and coronary artery bypass surgery (Dujardin et al., 1997; Karimi et al., 2008).

➢ *Nutrition and Metabolic History*

Malnutrition is also a proven factor that predisposes postoperative complications, such as infection, delayed wound healing, and increased hospital stay (Leandro-Merhi and de Aquino, 2014). Both short and long term mortality are independently predicted by acute kidney injury which is usually reflective of perioperative hemodynamic instability and underlying renal vulnerability (Abelha et al., 2009). The body of research in public health also proposes that it is chronic metabolic stress, substance use, and occupational health exposures that lead to an indirect elevation of surgical risk by depleting baseline physiological strength (Ashifa, 2020; Ashifa and Ramya, 2019).

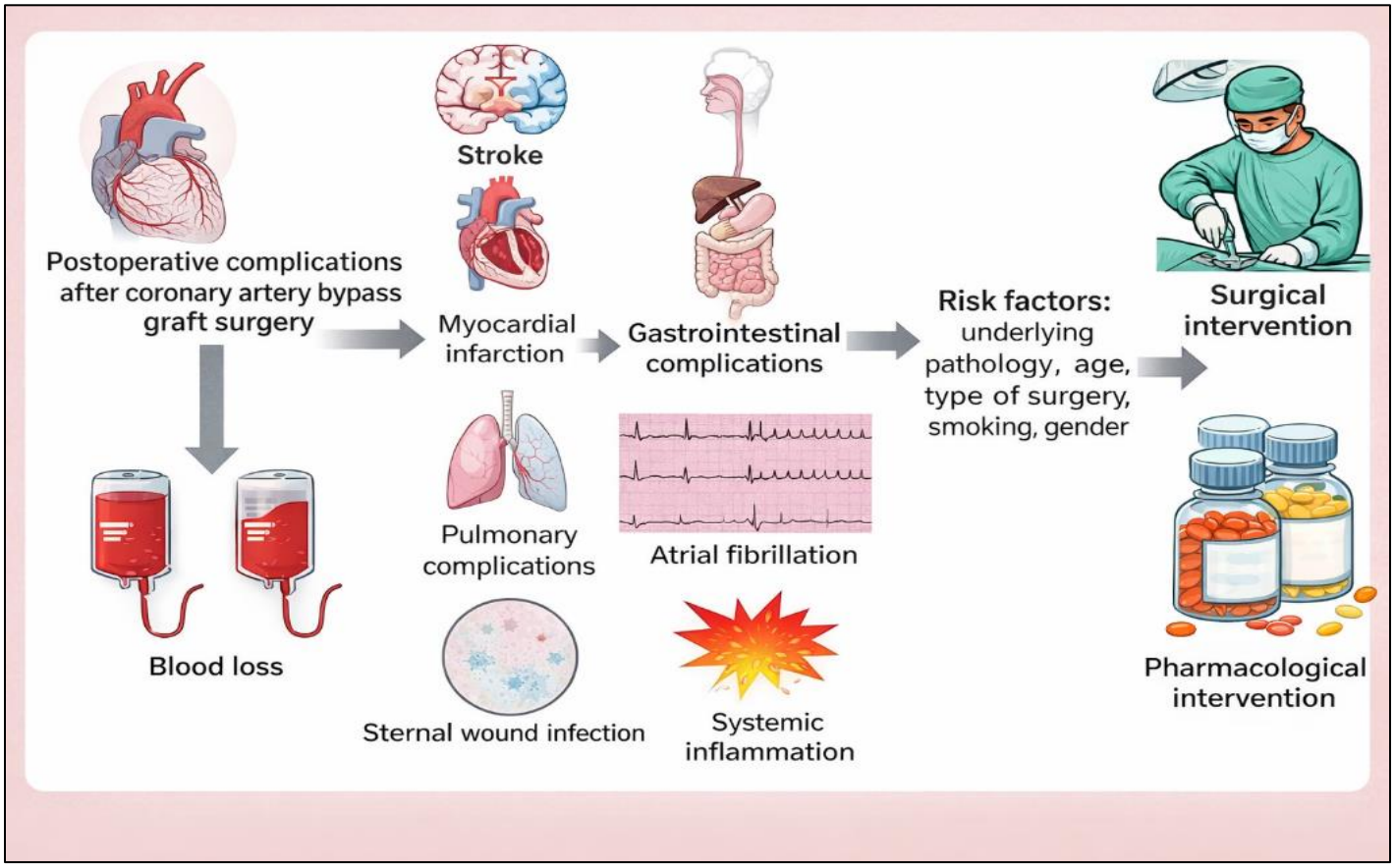

Fig 1: Postperative Complications after CABG Surgery

The outcome of postoperations is a product of biological susceptibility, the stress of the procedure, and the context of the health-system, as opposed to a result of the surgery itself. Baseline physiological reserve is characterised by patient related factors like age, frailty, comorbidity burden, malnutrition, and renal dysfunction. Procedural determinants such as the complexity of the operations, length of time, and blood loss, and emergency cases increase physiological stress. The determinants of the recovery paths include stability in hemodynamics, the length of ventilation, intensity of monitoring, and the availability of the ICU during perioperative care. In addition to clinical variables, social factors, such as socioeconomic status, availability of follow-up and psychosocial support, alter risk of complication and survival possibility independently. This is a multidimensional model that shows morbidity and mortality are cumulative risk exposures along the continuum of perioperative. Thus, successful surgical safety initiatives demand linking the risk stratification methods through the management of biomedical and nutrition, mental, and health-system appraisal in contrast to the procedure-based prediction models.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26mar1539

III. PROCEDURE AND DISEASE-SPECIFIC DETERMINANTS

➢ *Surgical Complexity and Emergency status.*

Emergency surgery is always linked to greater morbidity and mortality in comparison with elective operations since proper preoperative optimization and well-developed disease severity are not achieved in their case (Matsuyama et al., 2013). This is more evident during abdominal, thoracic and trauma surgery. The independent risk factors are always identified to be operative duration, blood loss and technical complexity during the procedure-specific studies in pneumonectomy, gastrointestinal surgery, and reoperative coronary bypass (Wahi et al., 1989; Persiani et al., 2008; He et al., 1995; Cui et al., 2004).

➢ *Indication and Disease Severity of Surgery*

Postoperative risk is greatly altered by underlying disease burden. As an illustration, more complication rates are correlated with advanced malignancy, multivalvular heart disease, and severe coronary pathology even within the high volume centers (Teoh et al., 1987; Persiani et al., 2008; He et al., 1995).

➢ *Perioperative and System-Level Determinants*

The perioperative management is a decisive factor in the postoperative outcomes. Morbidity is also caused by intraoperative hemodynamic unsteadiness, the extended mechanical ventilation, and insufficient postoperative monitoring of the patients especially the elderly and high-risk patients (Rady et al., 1998; Ferraris and Ferraris, 1996). Staffing, postoperative monitoring, and access to intensive care are health-system factors beyond the operating room that have a significant impact on postoperative survival (Moonesinghe et al., 2014). Recent research points out that the socioeconomic status, housing insecurity, and access to follow-up care are social determinants of health that have an independent predictive power of postoperative outcomes in all types of surgery (Khalid et al., 2022; Sullivan et al., 2024). Specifically, these results are useful in the resource-limited environment, where postoperative mortality is disproportionate (Tsehay et al., 2024).

➢ *Psychosocial and Population-level factors*

New data has attributed psychological stress, mental health literacy, and social support to surgical recovery paths. Poor mental health and chronic stress confer negative immune functions and slower recovery, both of which are indirect risk factors of complications (Ranganathan et al., 2024; Elkin et al., 2025). Further population-based research on the elderly and marginalized population shows that social isolation and lack of access to rehabilitation factors are associated with excess postoperative mortality (Ashifa, 2022, Rasi, and Ashifa, 2019). These lessons affirm the need to have holistic perioperative care models that go beyond biomedical optimization.

➢ *Baseline Characteristics and Postoperative Outcomes*

An institutional cohort of 85 adult surgical patients was examined to investigate determinants of post-operative morbidity and mortality, in order to put existing evidence into perspective. The evaluation of the outcomes was performed within 30 days of the postoperative period.

Table 1. Baseline Characteristics and Postoperative Outcomes (n = 85)

Variable	Category	n (%)
Age	<60 years	34 (40.0)
	≥60 years	51 (60.0)
Surgical urgency	Elective	52 (61.2)
	Emergency	33 (38.8)
Major comorbidity (≥2)	Present	47 (55.3)
	Absent	38 (44.7)
Postoperative morbidity	Yes	29 (34.1)
	No	56 (65.9)
30-day mortality	Yes	9 (10.6)
	No	76 (89.4)

Table 2. Determinants Associated with Postoperative Morbidity and Mortality

Determinant	Morbidity (%)	Mortality (%)
Age ≥60 years	45.1	15.7
Emergency surgery	51.5	21.2
≥2 comorbidities	53.2	19.1
Acute kidney injury	68.4	31.6
Malnutrition	57.1	23.8
Adverse social factors*	48.6	17.1

*Includes poor socioeconomic support, delayed presentation, and limited postoperative follow-up.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26mar1539

IV. DISCUSSION

The results of the published literature, as well as the illustrative cohort, support the claim that the phenomenon of postoperative morbidity and mortality is multifactorial. Old age, the presence of comorbidities, emergency operation, and kidney failure/malnutrition come out as the leading clinical determinants as it has been observed in the other large-scale studies (Ferraris and Ferraris, 1996; Khuri et al., 2005; Abelha et al., 2009). Notably, the negative social factors observed to be related to postoperative outcomes can be attributed to the presence of social determinants of health in the management of surgery (Khalid et al., 2022; Sullivan et al., 2024). Such findings reflect the shortcomings of the risk models which do not include psychosocial and system level factors.

V. CONCLUSION

The overall effects of patient susceptibility, the severity of disease, the complexity of surgery, perioperative care, and social background on patient health are manifested in postoperative morbidity and mortality. Although modern surgical practice and anesthesia have minimized the risk associated with the procedure, non-technical determinants are becoming more the order of the day. Biomedical risk evaluation combined with nutritional evaluation, psychosocial screening and interventions at the systems level are necessary to enhance postoperative survival and recovery. Further studies are needed to focus on multidimensional risk models and equal perioperative care paths that consider clinical and social determinants of surgical outcomes.

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