International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-01-48*

Impact Of Preoperative Medical Optimization And Anesthetic Management On Postoperative Outcomes Following Major Abdominal Surgery: A Prospective Multidisciplinary Study.

Dr. Mahesh V[1], Dr. Anagha S[2], Dr. Prashanth M[3*].

[1]Assistant Professor, Dept of General Surgery, Sri Madhusudan Sai Institute of Medical Sciences, Chikkaballapur, Karnataka, India

[2]Senior resident, Department of Anaesthesiology, Mahabodhi Medical College, Gaya, Bihar, India

[3]Assistant professor, Department of General Medicine, Chikkamagaluru Institute of Medical Sciences, Chikkamagaluru, Karnataka, India.

Correspondence:
Dr. Prashanth M.
Assistant professor, Department of General Medicine, Chikkamagaluru Institute of Medical Sciences, Chikkamagaluru, Karnataka, India.

Received: 16-12-2025
Revised: 30-12-2025
Accepted: 13-01-2026
Published: 26-01-2026

Abstract

Background: Major abdominal surgery is associated with considerable postoperative morbidity because of the physiological stress of surgery, underlying comorbidities, and perioperative risk factors. Preoperative abnormalities such as anaemia, uncontrolled diabetes, hypertension, malnutrition, and respiratory disorders may adversely affect postoperative recovery. In addition, intraoperative factors including hypotension, blood loss, transfusion, hypothermia, and prolonged surgery may contribute to postoperative complications. Integration of preoperative medical optimization with individualized anaesthetic management through a multidisciplinary approach may therefore improve surgical outcomes. ***Aim:*** To evaluate the impact of preoperative medical optimization and anaesthetic management on postoperative outcomes among patients undergoing major abdominal surgery. ***Materials and Methods:*** This prospective multidisciplinary observational study included 100 adult patients undergoing elective major abdominal surgery at a tertiary care teaching hospital. Patients underwent systematic preoperative assessment for demographic characteristics, comorbidities, ASA physical status, anaemia, glycaemic abnormalities, hypertension, nutritional risk, electrolyte disturbances, and respiratory abnormalities. Modifiable risk factors were appropriately optimized before surgery whenever indicated. Intraoperative anaesthetic parameters including hypotension, vasopressor requirement, blood loss, blood transfusion, duration of surgery, and hypothermia were recorded. Patients were prospectively followed for postoperative complications, ICU requirement, ICU stay, duration of hospitalization, reoperation, and mortality. Appropriate descriptive and inferential statistical tests were applied, and a p-value <0.05 was considered statistically significant. ***Results:*** The mean age of the study population was 54.8 ± 13.2 years, and 58% were males. Hypertension (38%), preoperative anaemia (34%), diabetes mellitus (31%), and nutritional risk (21%) were common preoperative factors. Overall, 64% required preoperative optimization, of whom 81.3% were adequately optimized. Postoperative complications occurred in 23% of patients. The complication rate was significantly higher among patients with incomplete optimization compared with adequately optimized patients (50.0% vs 19.2%; p=0.026). Intraoperative hypotension (56.5% vs 20.8%; p=0.001), vasopressor requirement (52.2% vs 22.1%; p=0.006), and blood transfusion (39.1% vs 15.6%; p=0.014) were significantly more frequent among patients who developed postoperative complications. Patients with complications also had significantly greater blood loss (612 ± 286 vs 394 ± 218 mL; p<0.001) and longer duration of surgery (226 ± 61 vs 181 ± 54 minutes; p=0.001). Intraoperative hypothermia was significantly associated with complications (34.8% vs 11.7%; p=0.010). Incomplete optimization was associated with higher ICU admission (41.7% vs 15.4%; p=0.049) and longer postoperative hospital stay (10.8 ± 3.5 vs 7.6 ± 2.4 days; p<0.001). ***Conclusion:*** Adequate preoperative medical optimization was associated with fewer postoperative complications, reduced ICU utilization, and shorter hospitalization following major abdominal surgery. Intraoperative hypotension, vasopressor requirement, blood transfusion, increased blood loss, prolonged surgery, and hypothermia were associated with adverse postoperative outcomes. A structured multidisciplinary perioperative approach combining preoperative optimization with individualized anaesthetic and hemodynamic management may contribute to improved postoperative recovery following major abdominal surgery.

Keywords: Major abdominal surgery; preoperative optimization; anaesthetic management; postoperative complications.

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INTRODUCTION

Major abdominal surgery includes complex gastrointestinal, hepatobiliary, pancreatic, and other intra-abdominal procedures and is associated with considerable perioperative morbidity and mortality worldwide. Despite advances in surgical techniques, anaesthesia, intensive care, and perioperative monitoring, postoperative complications remain an important cause of prolonged hospitalization, increased healthcare costs, and mortality. The International Surgical Outcomes Study reported postoperative complications in approximately 16.8% of patients undergoing elective inpatient surgery, demonstrating the substantial global burden of postoperative morbidity. [1] The outcome following major abdominal surgery depends on the magnitude of surgical stress, underlying comorbidities, physiological reserve, nutritional status, and quality of perioperative care. Advanced age, anaemia, diabetes mellitus, hypertension, cardiovascular disease, respiratory disorders, renal dysfunction, malnutrition, obesity, smoking, and poor functional capacity may increase postoperative risk.

In India, surgical patients frequently have multiple comorbidities and potentially modifiable risk factors, emphasizing the importance of structured preoperative assessment and optimization.[2] Preoperative medical optimization involves identifying and correcting modifiable abnormalities before surgery to improve the patient's ability to tolerate surgical stress .

It includes optimization of cardiovascular and respiratory diseases, glycaemic control, correction of anaemia and electrolyte abnormalities, nutritional intervention, medication management, smoking cessation, and improvement of functional capacity. Prehabilitation incorporating exercise, nutritional support, and physiological optimization has demonstrated potential benefits in reducing postoperative morbidity following major abdominal surgery.[3] Personalized prehabilitation among high-risk patients may improve functional reserve and reduce postoperative complications, supporting a patient-centred multidisciplinary approach.[4] Preoperative anaemia is an important modifiable risk factor associated with increased transfusion requirements and adverse postoperative outcomes, making its early identification and management essential.[5] Anaesthetic management also plays a pivotal role through appropriate anaesthetic technique, airway management, ventilation, hemodynamic stability, fluid therapy, temperature control, analgesia, and postoperative care.

Enhanced Recovery After Surgery (ERAS) pathways integrate preoperative optimization, standardized anaesthetic care, multimodal analgesia, appropriate fluid management, early nutrition, and mobilization to facilitate postoperative recovery.[6] Effective implementation of these multimodal perioperative strategies can reduce surgical stress, postoperative complications, and length of hospital stay. Intraoperative hypotension, inappropriate fluid administration, hypothermia, inadequate ventilation, and poorly controlled postoperative pain may adversely influence organ function and recovery.

Goal-directed hemodynamic management individualizes fluid and vasoactive therapy and has been associated with reduced postoperative complications following major abdominal surgery.[7] Preoperative optimization and intraoperative anaesthetic management are therefore complementary components rather than independent determinants of postoperative outcome.

A multidisciplinary approach involving anaesthesiologists, surgeons, physicians, intensivists, nurses, nutritionists, and physiotherapists may facilitate early identification and management of perioperative risk factors.

However, prospective evidence evaluating the combined influence of medical optimization and anaesthetic management remains particularly relevant in the Indian healthcare setting.

Hence, the present prospective multidisciplinary study was undertaken to assess the impact of preoperative medical optimization and anaesthetic management on postoperative outcomes following major abdominal surgery.

AIM

To evaluate the impact of preoperative medical optimization and anaesthetic management on postoperative outcomes among patients undergoing major abdominal surgery.

OBJECTIVES

Primary Objective

1. To assess the association between preoperative medical optimization and the occurrence of postoperative complications following major abdominal surgery.

Secondary Objectives

2. To evaluate the influence of intraoperative anaesthetic and hemodynamic management on postoperative outcomes, including postoperative complications, intensive care unit (ICU) requirement, and duration of hospital stay.
3. To identify preoperative and intraoperative factors associated with adverse postoperative outcomes following major abdominal surgery.

MATERIALS AND METHODS

Study Design

The study was conducted as a prospective multidisciplinary observational study.

Study Setting

The study was conducted in the Departments of Anaesthesiology and Surgery, in collaboration with the Departments of General Medicine and Critical Care Medicine, at a tertiary care teaching hospital.

Study Population

Adult patients who underwent elective major abdominal surgery during the study period and fulfilled the eligibility criteria were included in the study.

Sample Size

The study included a total of 100 patients undergoing elective major abdominal surgery.
The sample size was calculated using the formula:
$n = Z^2 \times p \times (1 - p) / d^2$
where:
n = required sample size, Z = 1.96 at 95% confidence level, p = anticipated proportion of postoperative complications, d = absolute precision.
Considering an anticipated postoperative complication rate of approximately 30% (p = 0.30) and an absolute precision of 9% (d = 0.09):
$n = (1.96)^2 \times 0.30 \times 0.70 / (0.09)^2$, n = 99.6
Therefore, the final sample size was rounded to 100 patients.

Sampling Technique

A consecutive sampling technique was used. All eligible patients undergoing major abdominal surgery during the study period were recruited consecutively until the required sample size of 100 was achieved.

INCLUSION CRITERIA

1. Patients aged 18 years and above were included.
2. Patients undergoing elective major abdominal surgery under general anaesthesia were included.
3. Patients belonging to American Society of Anaesthesiologists (ASA) physical status I–III were included.
4. Patients who provided written informed consent for participation were included.

EXCLUSION CRITERIA

1. Patients undergoing emergency abdominal surgery were excluded.
2. Patients undergoing minor or day-care abdominal procedures were excluded.
3. Patients with severe pre-existing or terminal organ failure were excluded.
4. Patients requiring immediate surgery before adequate preoperative assessment and optimization could be completed were excluded.
5. Patients who refused to provide informed consent were excluded.

STUDY PROCEDURE

After enrolment, demographic and clinical details including age, sex, body mass index, primary diagnosis, type of surgery, comorbidities, medication history, previous surgical history, smoking and alcohol history, and ASA physical status were recorded. All patients underwent a systematic preoperative assessment. Cardiovascular, respiratory, renal, hepatic, metabolic, haematological, and nutritional status were evaluated by clinical examination and appropriate investigations.

Preoperative investigations included complete blood count, blood glucose, renal function tests, liver function tests, serum electrolytes, coagulation profile, electrocardiography, and other investigations whenever clinically indicated. Potentially modifiable preoperative risk factors, including anaemia, uncontrolled hypertension, hyperglycaemia, electrolyte abnormalities, respiratory disorders, nutritional deficiencies, dehydration, and medication-related problems, were identified. Appropriate preoperative medical optimization was undertaken before surgery in consultation with the respective specialties whenever required. The abnormalities identified, interventions undertaken, and optimization status before surgery were documented.

ANESTHETIC MANAGEMENT

The anaesthetic plan was individualized according to the patient's clinical condition, type of surgery, anticipated duration of surgery, and institutional protocol. Standard intraoperative monitoring included electrocardiography, non-invasive blood

pressure, pulse oximetry, end-tidal carbon dioxide, and temperature monitoring. Invasive arterial blood pressure and other advanced monitoring modalities were used whenever clinically indicated. The anaesthetic technique, induction and maintenance agents, neuromuscular blockade, ventilation strategy, intravenous fluid administration, blood and blood-product transfusion, estimated blood loss, urine output, vasopressor or inotropic requirement, intraoperative hypotension, duration of anaesthesia, and duration of surgery were recorded. Intraoperative hypotensive episodes and the interventions undertaken for their correction were documented. Intravenous fluids, blood products, vasopressors, and inotropes were administered according to the patient's physiological requirements and institutional protocol. Multimodal analgesia was provided, and regional or neuraxial analgesic techniques were used whenever clinically indicated.

POSTOPERATIVE ASSESSMENT

Following surgery, patients were monitored in the post-anaesthesia care unit, surgical ward, or ICU according to their clinical condition. Patients were prospectively followed during hospitalization for the development of postoperative complications.

Postoperative outcomes assessed included pulmonary complications, cardiovascular complications, acute kidney injury, surgical-site infection, postoperative nausea and vomiting, postoperative pain, requirement for mechanical ventilation, unplanned ICU admission, duration of ICU stay, duration of postoperative hospital stay, reoperation, and in-hospital mortality.

STATISTICAL ANALYSIS

The collected data were entered into Microsoft Excel and analysed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on data distribution. Categorical variables were presented as frequencies and percentages.

The independent Student's t-test or Mann–Whitney U test was used for comparison of continuous variables, as appropriate. The Chi-square test or Fisher's exact test was used to assess associations between categorical variables. Multivariable logistic regression analysis was performed to identify independent preoperative and intraoperative predictors of postoperative complications.

Adjusted odds ratios with 95% confidence intervals were reported where applicable. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1. Baseline demographic and preoperative clinical characteristics of the study population (N=100)

Characteristic	Result
Age, years, Mean ± SD	54.8 ± 13.2
Age ≥60 years	39 (39.0%)
Male	58 (58.0%)
Female	42 (42.0%)
BMI, kg/m², Mean ± SD	24.9 ± 3.8
ASA Grade I	16 (16.0%)
ASA Grade II	53 (53.0%)
ASA Grade III	31 (31.0%)
Hypertension	38 (38.0%)
Diabetes mellitus	31 (31.0%)
Cardiovascular disease	12 (12.0%)
Chronic respiratory disease	10 (10.0%)
Preoperative anemia	34 (34.0%)
Nutritional risk/malnutrition	21 (21.0%)
≥2 comorbidities	29 (29.0%)

Interpretation: The mean age of the study population was 54.8 ± 13.2 years, with 39% aged ≥60 years. Hypertension (38%), anemia (34%), and diabetes mellitus (31%) were common preoperative risk factors. A substantial proportion of patients belonged to ASA Grade II or III, indicating a clinically relevant burden of preoperative risk.

Table 2. Preoperative abnormalities identified and optimization undertaken (N=100)

Preoperative factor	Patients identified n (%)	Patients optimized n (%)
Anemia	34 (34.0%)	27 (79.4%)
Poor glycemic control	24 (24.0%)	20 (83.3%)
Uncontrolled hypertension	18 (18.0%)	16 (88.9%)
Nutritional deficiency/risk	21 (21.0%)	15 (71.4%)
Electrolyte abnormality	14 (14.0%)	13 (92.9%)
Respiratory optimization required	12 (12.0%)	10 (83.3%)
Medication-related optimization	16 (16.0%)	15 (93.8%)
Overall optimization required	**64 (64.0%)**	**52 (81.3%)**

Interpretation: Preoperative optimization was required in 64 patients, of whom 52 (81.3%) were adequately optimized before surgery. Anemia was the most frequently identified modifiable abnormality, followed by poor glycemic control and nutritional risk. These findings demonstrate the considerable burden of potentially modifiable preoperative factors among patients undergoing major abdominal surgery.

Table 3. Association between preoperative medical optimization and postoperative complications

Preoperative status	Postoperative complication n (%)	No complication n (%)	Total	p-value
Adequately optimized	10 (19.2%)	42 (80.8%)	52	**0.026**
Optimization indicated but incomplete	6 (50.0%)	6 (50.0%)	12	
No optimization required	7 (19.4%)	29 (80.6%)	36	
Total	**23 (23.0%)**	**77 (77.0%)**	**100**	

Interpretation: Postoperative complications occurred in 23% of the overall study population. Patients in whom indicated preoperative optimization remained incomplete had a significantly higher complication rate (50.0%) compared with adequately optimized patients (19.2%) and patients who did not require optimization (19.4%). The association was statistically significant (**p=0.026**), suggesting that completion of indicated preoperative optimization was associated with better postoperative outcomes.

Table 4. Association of intraoperative anaesthetic and hemodynamic factors with postoperative complications

Intraoperative factor	Complication group (n=23)	No-complication group (n=77)	p-value
Intraoperative hypotension	13 (56.5%)	16 (20.8%)	**0.001**
Vasopressor requirement	12 (52.2%)	17 (22.1%)	**0.006**
Blood transfusion	9 (39.1%)	12 (15.6%)	**0.014**
Blood loss, mL, Mean ± SD	612 ± 286	394 ± 218	**<0.001**
Duration of surgery, min, Mean ± SD	226 ± 61	181 ± 54	**0.001**
Intraoperative hypothermia	8 (34.8%)	9 (11.7%)	**0.010**

Interpretation: Intraoperative hypotension was observed in 56.5% of patients who developed postoperative complications compared with 20.8% without complications (**p=0.001**). Vasopressor requirement, blood transfusion, greater intraoperative blood loss, longer surgical duration, and intraoperative hypothermia were also significantly associated with postoperative complications. These findings indicate that maintenance of hemodynamic stability and appropriate anaesthetic management may have an important influence on postoperative recovery.

Table 5. Postoperative outcomes according to adequacy of indicated preoperative optimization

Postoperative outcome	Adequately optimized (n=52)	Incomplete optimization (n=12)	p-value
Any postoperative complication	10 (19.2%)	6 (50.0%)	**0.032**
Pulmonary complication	4 (7.7%)	4 (33.3%)	**0.031**
Acute kidney injury	2 (3.8%)	2 (16.7%)	0.142
Surgical-site infection	3 (5.8%)	2 (16.7%)	0.225
ICU admission	8 (15.4%)	5 (41.7%)	**0.049**
ICU stay, days, Mean ± SD*	2.1 ± 1.0	3.8 ± 1.5	**0.018**
Postoperative hospital stay, days, Mean ± SD	7.6 ± 2.4	10.8 ± 3.5	**<0.001**
In-hospital mortality	1 (1.9%)	1 (8.3%)	0.342

*ICU stay was assessed among patients requiring ICU care.

Interpretation: Patients with incomplete preoperative optimization experienced a higher overall postoperative complication rate (50.0% vs 19.2%), greater pulmonary morbidity, and more frequent ICU admission than adequately optimized patients. They also had longer ICU and postoperative hospital stays. Mortality was numerically higher with incomplete optimization but did not reach statistical significance. Overall, these findings support an association between adequate preoperative medical optimization and improved postoperative recovery following major abdominal surgery.

DISCUSSION

The present prospective multidisciplinary study evaluated the influence of preoperative medical optimization and intraoperative anaesthetic management on postoperative outcomes in 100 patients undergoing major abdominal surgery. The study population had a mean age of 54.8 ± 13.2 years, and 39% of patients were aged ≥60 years, while 84% belonged to ASA physical status II or III, indicating a substantial baseline perioperative risk burden. Higher ASA physical status has consistently been associated with increasing postoperative morbidity and mortality, and Foley et al. demonstrated the value of ASA classification as an independent predictor of postoperative medical complications and mortality in a large surgical population. [8]

Preoperative abnormalities requiring optimization were identified in 64% of patients in the present study, demonstrating that potentially modifiable risk factors were highly prevalent before major abdominal surgery. Anaemia was the commonest abnormality, affecting 34% of patients, followed by poor glycaemic control in 24%, nutritional risk in 21%, and uncontrolled hypertension in 18%. These findings are clinically important because preoperative anaemia has repeatedly been associated with adverse postoperative outcomes. Fowler et al., in a meta-analysis involving 949,445 surgical patients, reported a preoperative anaemia prevalence of 39.1% and found that anaemia was associated with approximately 2.9-fold higher mortality, 3.75-fold higher odds of acute kidney injury, and 1.93-fold higher odds of infection.[9] The 34% prevalence of anaemia observed in the present study was therefore comparable to the 39.1% pooled prevalence reported in their analysis. Nutritional risk or malnutrition was identified in 21% of the present population. Kanemoto et al., in a prospective cohort of 1,248 patients undergoing elective abdominal surgery, reported that 33.0% were at risk of malnutrition and 6.9% were malnourished; 12.4% developed major postoperative complications. They further demonstrated that poorer preoperative nutritional status independently predicted major postoperative complications and was associated with prolonged postoperative hospitalization. [10] These observations support the inclusion of nutritional assessment and correction of nutritional deficiencies as important components of multidisciplinary preoperative optimization.

Among the 64 patients requiring optimization in the present study, adequate optimization was achieved in 52 (81.3%), whereas optimization remained incomplete in 12 patients. Postoperative complications occurred in 19.2% of adequately optimized patients compared with 50.0% of patients with incomplete optimization, and this difference was statistically significant (p=0.026). This finding strongly suggests that identification of risk factors alone may be insufficient and that correction of modifiable abnormalities before surgery is important. Gillis et al., in a randomized trial of patients undergoing colorectal cancer resection, demonstrated that structured prehabilitation initiated before surgery improved functional recovery compared with rehabilitation commenced only after surgery, reinforcing the concept that preparation and optimization should begin during the preoperative period. [11] Overall, postoperative complications occurred in 23% of patients in the present study. Intraoperative hypotension was significantly more frequent among patients who developed complications than among those without complications (56.5% vs 20.8%; p=0.001). The association observed in our study is consistent with the Perioperative Quality Initiative consensus evaluation by Sessler et al., which concluded that intraoperative hypotension is strongly associated with myocardial injury, acute kidney injury, and mortality, with risk increasing according to both severity and duration of hypotension.[12] Thus, avoidance of prolonged hypotension and maintenance of adequate organ perfusion represent potentially modifiable components of anaesthetic management.

Vasopressor requirement was also significantly higher in patients who developed postoperative complications (52.2%) compared with those without complications (22.1%; p=0.006). This finding likely reflects greater intraoperative hemodynamic instability among patients experiencing adverse outcomes. Evidence from goal-directed hemodynamic management studies supports individualized optimization of circulatory parameters. Sun et al., in a systematic review and meta-analysis of randomized controlled trials involving major abdominal surgery, found that perioperative goal-directed hemodynamic therapy was associated with improved postoperative recovery and reductions in postoperative morbidity, particularly among higher-risk surgical patients. [13]. Perioperative fluid management represents another important determinant of organ perfusion and postoperative recovery. Although excessive fluid administration may contribute to tissue edema and pulmonary morbidity, excessive restriction can also compromise renal perfusion. The RELIEF trial by Myles et al. compared restrictive and liberal fluid regimens in 2,983 patients undergoing major abdominal surgery and demonstrated that restrictive fluid therapy did not improve disability-free survival and was associated with a significantly greater incidence of acute kidney injury (8.6% vs 5.0%).[14] These observations emphasize that individualized, physiologically appropriate fluid administration is preferable to indiscriminate fluid restriction.

In the present study, patients who developed postoperative complications experienced significantly greater intraoperative blood loss (612 ± 286 mL) than those without complications (394 ± 218 mL; p<0.001), while perioperative blood transfusion was required in 39.1% of the complication group compared with 15.6% of patients without complications (p=0.014). Musallam et al., in a large cohort of patients undergoing major non-cardiac surgery, demonstrated that even mild preoperative anemia was independently associated with increased postoperative morbidity and mortality.[15] These findings, together with the present results, underline the importance of correcting anemia before elective surgery, minimizing intraoperative blood loss, and adopting appropriate patient blood-management strategies. Duration of surgery was significantly greater among patients who developed complications (226 ± 61 minutes) compared with patients without complications (181 ± 54 minutes; p=0.001). Cheng et al., in a systematic review evaluating operative duration and surgical-site infection, demonstrated that patients who developed surgical-site infections had operations approximately 30 minutes longer on average and that the likelihood of surgical-site infection increased with increasing operative duration.[16] The present finding therefore supports prolonged operative duration as an important marker of surgical complexity and postoperative risk.

Intraoperative hypothermia was documented in 34.8% of patients who developed complications compared with 11.7% without complications (p=0.010). Kurz et al., in a randomized study of 200 patients undergoing colorectal surgery, demonstrated that maintenance of perioperative normothermia significantly reduced surgical-wound infections and shortened hospitalization compared with patients experiencing mild hypothermia. [17] This finding is consistent with the present results and emphasizes active temperature monitoring and warming as important components of anaesthetic care during prolonged abdominal procedures. The clinical consequences of incomplete optimization were also evident in postoperative resource utilization. ICU admission occurred in 41.7% of incompletely optimized patients compared with 15.4% of adequately optimized patients (p=0.049), while mean postoperative hospital stay was significantly longer in the incompletely optimized group (10.8 ± 3.5 vs 7.6 ± 2.4 days; p<0.001). Pulmonary complications were similarly more frequent among incompletely optimized patients (33.3% vs 7.7%; p=0.031). Gallart and Canet highlighted that postoperative pulmonary complications are important contributors to postoperative morbidity, mortality, ICU utilization, and prolonged hospitalization, particularly after major abdominal procedures. [18]

Taken together, the present findings demonstrate that postoperative outcomes following major abdominal surgery were influenced by both the patient's preoperative condition and the quality of intraoperative anaesthetic management. Adequate preoperative optimization was associated with fewer complications, lower ICU utilization, and shorter hospitalization, whereas intraoperative hypotension, vasopressor requirement, increased blood loss, transfusion, prolonged surgery, and hypothermia were significantly associated with adverse outcomes. These results reinforce the concept that perioperative risk should be addressed through a multidisciplinary continuum of care involving systematic preoperative identification and correction of modifiable risk factors, individualized anaesthetic and hemodynamic management, maintenance of normothermia, appropriate fluid and blood management, and structured postoperative surveillance.

CONCLUSION

The present prospective multidisciplinary study demonstrated that both preoperative medical optimization and intraoperative anaesthetic management had an important influence on postoperative outcomes following major abdominal surgery. Potentially modifiable preoperative abnormalities were identified in 64% of patients, with anaemia, poor glycaemic control, nutritional risk, and uncontrolled hypertension being the most frequent abnormalities. Adequate preoperative optimization was achieved in 81.3% of patients who required intervention. Patients with incomplete optimization had a significantly higher incidence of postoperative complications compared with adequately optimized patients (50.0% vs 19.2%; p=0.026). Incomplete optimization was also associated with a greater incidence of pulmonary complications, increased ICU admission, longer ICU stay, and prolonged postoperative hospitalization. Intraoperative factors including hypotension, vasopressor requirement, blood transfusion, greater blood loss, prolonged duration of surgery, and hypothermia were significantly associated with postoperative complications. These findings highlight the importance of maintaining hemodynamic stability, normothermia, appropriate fluid and blood management, and individualized anaesthetic care throughout major abdominal surgery.

The study therefore emphasized that perioperative risk reduction should begin before surgery and continue throughout the intraoperative and postoperative periods. A structured multidisciplinary approach involving early identification and correction of modifiable preoperative risk factors, appropriate anaesthetic planning, optimized hemodynamic management, and vigilant postoperative monitoring may reduce postoperative morbidity, ICU utilization, and duration of hospitalization following major abdominal surgery.

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